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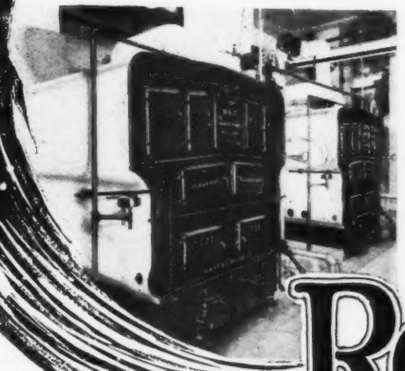

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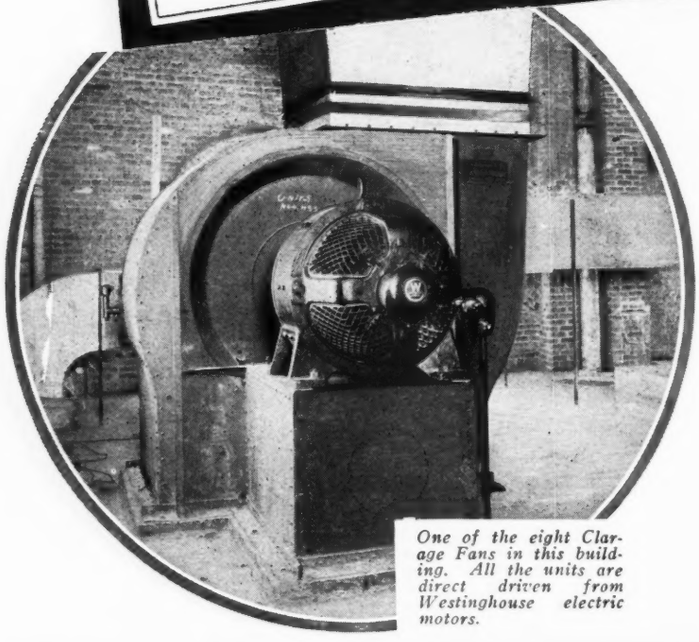

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We Need More Brains in Heating System Design

Economy of Operation is Insufficiently Considered in the Vast Majority of Cases, Based Upon a Recent Extensive Study in Detroit

By J. H. Walker

Superintendent of Central Heating, The Detroit Edison Company.

THE mechanical problems of heating system design may be said to have been solved in a fairly satisfactory manner. Pipe sizes and arrangements, boilers and specialties, as a rule, are selected and installed in an acceptable fashion. But the layout of systems from the standpoint of convenient and economical operation has been surprisingly neglected. In fact, the results of a recent extensive study of a large number of modern heating systems in Detroit constitute a serious indictment of present methods of design. Of 62 heating systems studied with a view to effecting economies in operation, 32 were found to be poorly laid out and when in eleven of these cases the faults were corrected, an average decrease of 25% occurred in the steam consumption.

Waste in steam consumption is especially serious in district heating service. It is easily discovered, since the supply is metered, and it is objectionable to both the supplying company and the consumer because of the dissatisfaction which it creates in the mind of the latter. The very nature of the service—the fact that the consumption must be controlled by valves rather than by deliberately supplying fuel to a boiler—makes careful regulation imperative if excessive heating costs are to be avoided.

Much has been accomplished by district heating companies in educating their consumers in economical methods of operation, but unless the heating system is properly arranged for the actual conditions of use, all such instruction is of little value.

The following table is a summary of the results of careful investigations of a large number of buildings:

	No. of Cases	Average Saving After Correction
Faults in Design		
Insufficient subdivision of system...	17	33% in 4 cases*
Inconvenient means for operation of system.	15	24% in 7 cases
Miscellaneous faults	12	0
Faults in Operation		
Improper operation	34	35% in 26 cases
General failure to appreciate value of shutting off steam.	3	30% in 1 case
Equipment in bad condition.	9	17% in 1 case
Building in bad condition.	3	26% in 1 case
Total.	93	
More than one heading. . . .	31	
Total investigations.	62	

*i. e. the number of cases in which the consumer carried out the recommendations made as to the changes in piping or methods of operation.

What were these faults in design? A small hotel had no separate main for heating the lobby at night. When this was installed, allowing the remainder of the system to be shut off, a 50% decrease in steam consumption resulted.

In a garage the piping was so arranged that the entire building was kept warm to supply steam to a water heater and to a protective coil in a sprinkler tank.

In a building divided up into a number of small retail stores it was necessary for each storekeeper to go outside and enter a basement room to shut the valve controlling his heat supply. Small wonder that he left it open day and night until a remote-control valve was installed.

INACCESSIBLE VALVES

Inaccessible valves have cost thousands of dollars in wasted heat. A night watchman or janitor will not hunt up a ladder and climb to shut off a valve, nor will he shut a dozen radiator valves in rooms where heat is not needed. Simple, accessible means of control are absolutely essential. Is it asking too much of the designer of the heating system to give thought to such matters? We think not. Refinements of design which involve savings of the magnitude of these are as worth while in heating system design as in the design of any other piece of apparatus.

The design of a heating system which is to be served from a district heating plant should embody certain fundamental principles from a standpoint of operating economy. The foremost of these, though often neglected, is almost too obvious to mention. It is this—the system should be capable of being shut off, in whole or in part, and with the utmost convenience, for as many hours of the day as possible.

IMPORTANCE OF SUBDIVISIONS OF HEATING SYSTEM

This principle requires intelligent subdivision of the system so that the heat in portions of the building having short hours of occupancy or requiring less heat can be independently controlled. It requires that valves be placed in accessible positions or provided with extension stems. It requires, in subdivided buildings, remote control for valves necessarily distant from the respective portions heated. It requires sufficient radiation so that the building can be reheated in a reasonable time if the heat is shut off at night. It does *not* necessarily require any considerable increase in the cost of the heating system, but it does call for the expenditure of more or less gray matter and for a careful study of conditions by the designing engineer.

Many of these and other considerations apply not only to buildings served from a district heating system but to those heated by their own boilers. For example, it has been definitely demonstrated* that by varying the steam pressure in the radiators, above and below atmosphere, the radiator temperatures and consequently the heat output can be controlled according to weather conditions, as would naturally be expected. Nevertheless, one of the largest architect's offices in the middle West denies this fact absolutely.

Much, of course, could be said regarding unintelligent methods of operation practiced by the consumer. In his case we should be lenient. He has been the victim of much faulty advice. He has been told that it is more economical to leave his steam turned on from fall till spring than to shut it off. He has been told of the great virtue of water pans on the radiators. More often he has not been educated at all and he is sometimes the victim of his employees as was the office building owner whose night watchman kept the entire building at 70° so that he would be comfortable in making his rounds.

It is the task of the district heating company to educate its customers. It should be the task of the heating system designer to produce a system, which if properly operated, will give the best all round economy.

*See the "Economical Utilization of Heat from Central Stations" by N. W. Calvert and J. E. Seiter—A. S. H. & V. E., 1924.

An English Rule For Figuring Hot Water Radiation

Let it be supposed that a room in a residence is 20 ft. by 16 ft. by 10 ft. high. One outside wall (16 ft.) and one inside wall next to an unwarmed room. Window glass, 9 ft. by 6 ft. Temperature rise to be 30° F., say 60° when 30° F. outside.

	B.T.U.
Window glass (at coefficient of 1.0)	54
13½ in. outside wall, less window, 106 sq. ft. (at coefficient of 0.28)	30
9 in. inside wall against cold room, 200 sq. ft. (at coefficient of 0.3)	60
Floor, 320 sq. ft. (at coefficient of 0.05)	16
Ceiling, 320 sq. ft. (at coefficient of 0.4)	128
Air contents, 3200 cu. ft., two changes=6400 cu. ft. (at coefficient of 0.02)	128
	416

416 x 30 deg. rise = 12,480 B.T.U.

The number of B.T.U. emitted per square foot of surface, per hour, for each degree F. difference between the temperature of the water in the radiator and that of the air of the room, is: Single-col. radiators, 1.4; 2-col., 1.35; 3-col., 1.3; 4-col., 1.25. It is a common rule in England to work to a difference of 100° F. that is, water 160°, air 60°, for which the decimal point is removed. Two-column thus becomes 135 B.T.U. emitted per foot of surface per hour. For work where cost will admit, it is better to allow for the water being 150°, or even 145° in the radiators, though the higher figure, 160°, is justified where necessary, provided the boiler will do the duty in severe weather. There is, however, a growing feeling in favor of low-temperature radiation if the customer will pay for it.

Based on 100° difference, water and air, the figure for heat losses from the room per hour, 12,480, needs only to be divided by (for 2-col. radiation) 135 to find the square feet of radiator surface required, which is 92½ sq. ft.—FREDERICK W. DYE, in *The Plumber and Journal of Heating, (London)*.

Practical Notes on House-heating By Gas

Data Compiled by the American Gas Assoctation Which Give the Necessary Information for Figuring This Class of Work

FOR many years the American Gas Association, through its Committee on House-Heating, has been gathering information on the use of gas as a fuel in house heaters. Several reports have been issued by this committee, but so rapid has been the advance in gas house-heating practice, that the reports of even a few years ago must now be considered out-of-date.

Recently the association undertook the publication of a reference book on the application of gas to house-heating. This has now been published under the title of "House Heating." It is undoubtedly the most complete treatise on the subject which has appeared to date and, at the same time, embodies what may be considered present practice in the gas house-heating industry.

Considering in a general way the use of gas for house-heating, the frank statement is made that "the actual experiences in more than 2000 towns in the natural gas territory where gas-fired house-heating has been tried on a large scale, shows the folly of attempting universal manufactured gas house-heating on account of the load characteristics and the enormous investment in a plant which would only be used to a very limited extent, in comparison to the size required to meet the extremes of demand." The authors go even further by stating that "the obvious suggestion of demand limitation brings with it a hint of surrender and implies that the consumer will have to turn back to coke, coal or oil whenever the cold becomes most severe and he feels the greatest need of automatic fuel and freedom from boiler worries."

At the same time the fact is recognized that the amount of house-heating by gas will continue to increase in almost every section of the country and, for that reason, the necessary data on the subject should be made available to everyone interested.

FIGURING THE DAILY HOUSE-HEATING LOAD

One of the first steps is to determine the daily house-heating load. This, of course, will depend

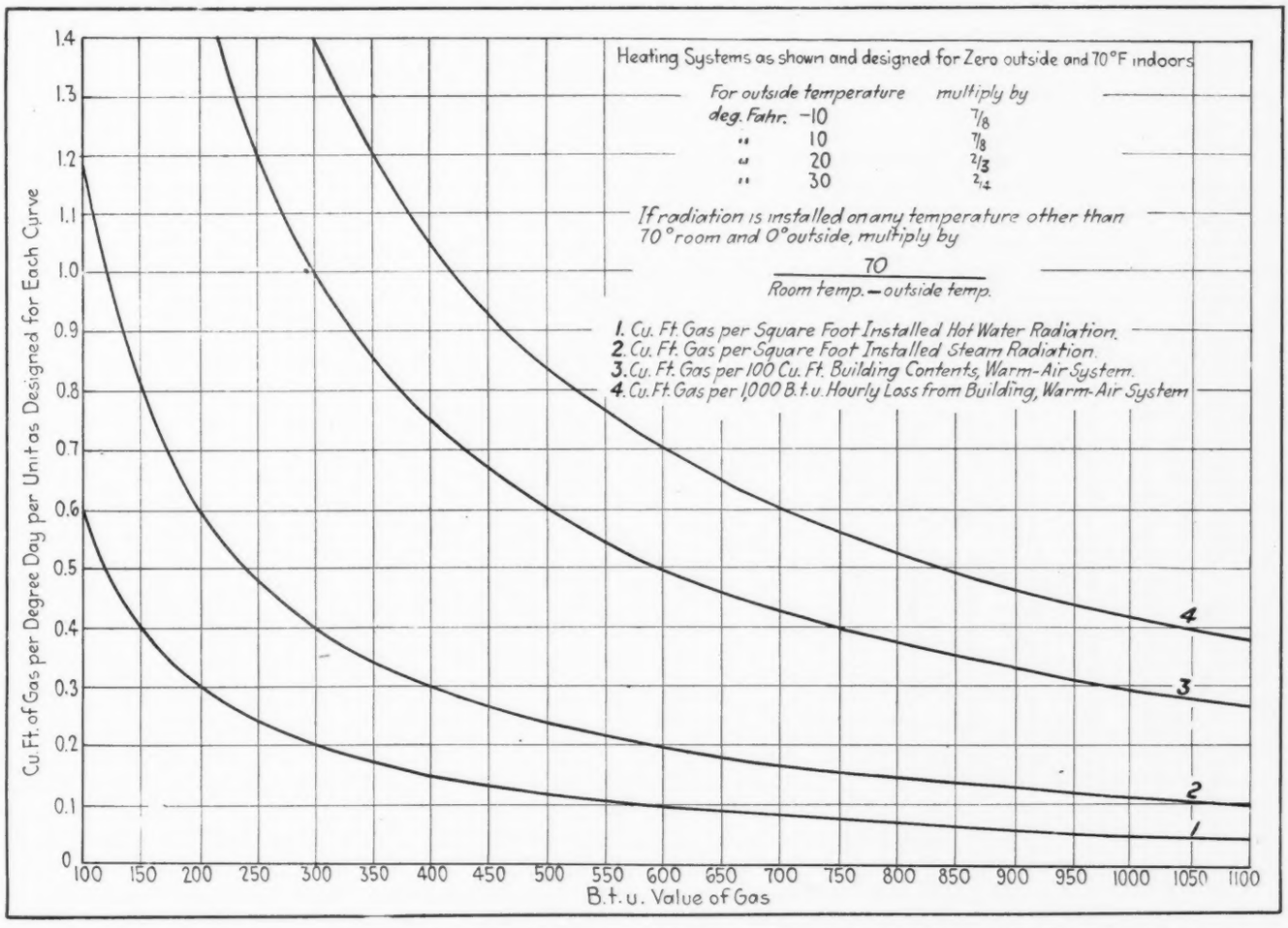
Heating Systems as shown and designed for Zero outside and 70°F indoors
For outside temperature multiply by
deg. Fahr. -10 7/8
" 10 7/8
" 20 2/3
" 30 2/4
If radiation is installed on any temperature other than 70° room and 0° outside, multiply by
70 / Room temp. — outside temp.
1. Cu. Ft. Gas per Square Foot Installed Hot Water Radiation.
2. Cu. Ft. Gas per Square Foot Installed Steam Radiation.
3. Cu. Ft. Gas per 100 Cu. Ft. Building Contents, Warm-Air System.
4. Cu. Ft. Gas per 1,000 B.t.u. Hourly Loss from Building, Warm-Air System
Cu. Ft. of Gas per Degree Day per Unit as Designed for Each Curve
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4
100 150 200 250 300 350 400 450 500 550 600 650 700 750 800 850 900 950 1000 1050 1100
B.t.u. Value of Gas
4
3
2
1

Fig. 1.—Chart for Estimating Gas Requirements for Steam, Water and Warm-Air Heating Systems

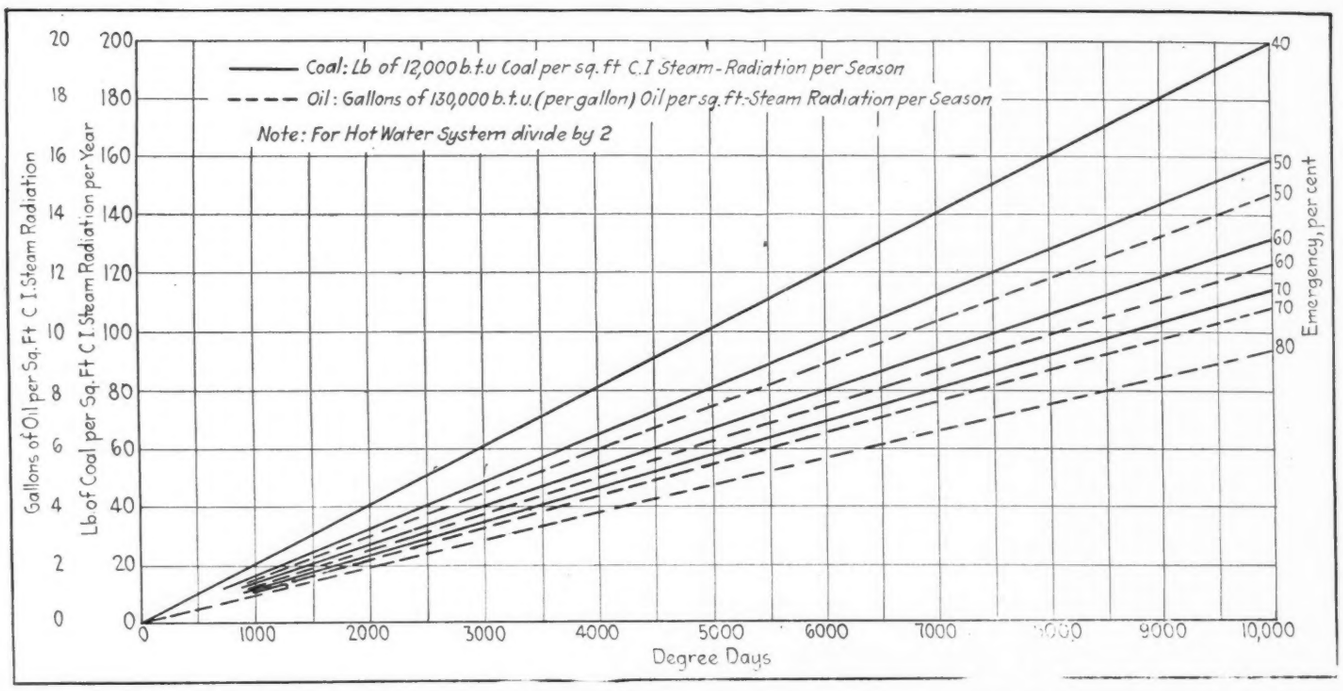

Fig. 2.—Chart Showing Quantities of Coal and Oil Required for Steam Heating Systems Operating Under Various Overall Efficiencies

on the outside temperature, the direction and velocity of wind and to some extent on the amount of sunshine. In order to make the prediction of the gas demand easy of calculation, the lesser variables have been disregarded, and only the outside temperature considered.

To calculate the gas requirement, the unit "degree days" has been introduced. This is defined as the product of the number of degrees below the mean temperature 65° F. and the number of days. For one day the latter factor is unity. The number of degree days, then, is numerically equal to the difference between 65° and the average temperature for that day. For example: a day when the outside average temperature is 0° F. is said to have 65 degree days. If the mean outside temperature had been –10 F., there would have been 75 degree days.

By means of a great many actual practice figures, selected from the best results which have been obtained by various gas companies, it is possible to determine unit values which can be used anywhere —applying the local conditions to determine the local gas requirements. For each of these operating results a separate calculation was made to determine what was the amount of gas per degree day for one unit of heating, of either steam, hot water or warm-air systems. These figures were then averaged and plotted on Fig. 1. This chart can be used to estimate the gas requirements for steam, hot water or warm-air systems designed for any desired exterior or interior temperatures, by applying suitable factors (see Fig. 1) and multiplying the unit value so determined by the number of degree days in the period of time for which the gas consumption is required.

The units employed as a basis for Fig. 1 are as follows: (a) for steam heating the square foot of cast-iron direct radiation emits 240 B.T.U. per hour in still air at 70° F. with the steam pressure assumed to be 2 lbs. (b) for water heating, the square foot of cast-iron radiation emits 150 B.T.U. per hour with a water temperature of 170° F. (c) for warm-air heating, the heating requirements are based on a 1000 B.T.U. hourly loss of heat from the building (inside temperature 70° F.—outside 0° F.) and for quick estimates on 100 cu. ft. building contents.

Several interesting deductions can be made from the curve besides the estimation of fuel requirements. For 600 B.T.U. gas, 0.2 cu. ft. are required per degree day per square foot of steam radiation under room temperature control. Thus, the optimum efficiency of such a system can be calculated as shown below. In the example shown the outside temperature is assumed to be 0° F.

$$\text{Eff.} = \frac{\text{Output}}{\text{Input}} = \frac{240 \text{ B.T.U.} \times 24 \text{ hrs.} \times 100}{0.2 \text{ cu. ft.} \times 600 \text{ B.T.U.} \times 65^*} = 73.84\%$$

In the case of water heating under both room and water temperature automatic control, it will require 0.1 cu. ft. of 600 B.T.U. gas per degree day per square foot of hot water radiation. This is equivalent to an overall efficiency of 92.30%.

In the case of warm-air heating under room temperature control, it will require approximately 0.7 cu. ft. of 600 B.T.U. gas per degree day for every 1,000 B.T.U. loss of the building on a 0° F. day, which is equivalent to an overall efficiency of 87.91%.

As stated before, for rough work in warm-air systems it is easier to estimate the gas on the basis of the cubic contents of the building, but it must be remembered that the values of this curve are much affected by building construction, exposure to wind, etc., which factors are taken care of when using the curve based on the B.T.U. loss.

*Degree Days—When outside temperature is 0° F. there are 65 degree days per 24 hours.

In order to determine the effects of the coldest days on the gas requirements for house-heating, it is only necessary to read from the chart the gas requirement per degree day for the proper B.T.U. value and heating system, and to multiply this by the number of degree days, and again by the number of units of heating involved. For a large number of installations, the latter figure is the sum of the individual amounts of radiation or heat loss.

HOW TO USE THE CHART

Example 1: What would be the gas consumption for a town having 25 steam heating installations, average amount of radiation installed 400 sq. ft., 20 hot water installations with an average of 640 sq. ft. installed radiation, and 100 warm-air systems in homes whose cubical contents averaged 15,000 cu. ft., on a day when the average outside temperature was 10° F. and the gas supplied contained 550 B.T.U. per cubic foot?

Read on the chart (Fig. 1) across from the intersection of the line at 550 B.T.U. with the corresponding curves.

Steam	0.22 x 55 x 400 x 25	121,000 cu. ft.
Hot water	0.11 x 55 x 640 x 20	77,500 cu. ft.
Hot Air	0.54 x 55 x 150 x 100	446,000 cu. ft.
Total		644,500 cu. ft.

Similarly, for the seasonal requirements of a particular installation, it is only necessary to use the proper degree-day figure in place of those shown in the above example.

BALANCING LOADS

To offset in a limited way the unfavorable load features of house-heating, several means have been suggested. Water heating during the summertime offers exceptional possibilities for balancing the house-heating load provided that the latter is comparatively small, because there is a definite limit to the amount of water heating that can be installed in a given community. The total number of large water heating systems would be very small when compared to the limits of house-heating possibilities.

To show the effect of a combination of house-heating and water heating assume a boiler with the proper rating to supply 500 sq. ft. of steam radiation for house-heating in a climate similar to New York and an equal size boiler installed in an automatic hot water storage system.

House heating boiler:	
Maximum day	6,000 cu. ft.
Total gas cons	550,000 cu. ft.
Ratio 1/90	
Water heating boiler:	
Maximum day	5,330 cu. ft.
Total gas cons	800,000 cu. ft.
Ratio 1/150	

Combining these two, the total consumption will be 1,350,000 cu. ft. per year and a resultant ratio of 1/225 for the maximum day which is a load even better than exists for some companies to-day. Such a water heating installation would be equivalent to the requirements of twenty average homes, a sixty-room hotel, a restaurant serving a thousand meals per day or an office building with a floor area of 100 x 100 and a height of ten stories. As before stated, the application is limited but it should be cultivated to assist in balancing the house-heating load, along with the industrial uses previously mentioned.

With the increasing gas-fired house-heating, the possibilities of securing large consumers, who would use coal in winter and gas in summer, will decrease. Thus, this application is limited in two ways; first, size of installation required to balance house-heating; second, limiting effect of increasing number of gas-fired house-heating systems.

Refrigeration has also been suggested as a logical counterpart of winter heating. The same arguments are valid in this case. The amount of gas required for complete control of the refrigeration business would be entirely insufficient to offset more than a small percentage of the prospective gas-fired house-heating systems.

Table 1 shows the comparative gas requirements for various domestic uses and their distribution month by month.

TABLE 1
Average 8 Room House—5 in Family
(5,400 Degree Days)
Cubic Feet of Gas per Month for Each Domestic Use

	Cooking	Hot Water and Laundry	House-Heating	Refrigeration	Total for Month
January	1,500	3,600	100,000	400	105,500
February	1,500	3,600	95,000	400	100,500
March	1,500	3,600	80,000	600	85,700
April	1,200	3,300	45,000	800	50,300
May	1,200	3,000	7,000	1,000	12,200
June	1,000	2,700	.....	1,200	4,900
July	800	2,300	.....	1,500	4,600
August	800	2,000	.....	1,500	4,300
September	1,000	2,500	.....	1,200	4,700
October	1,200	2,800	25,000	1,000	30,000
November	1,500	3,300	60,000	700	65,500
December	1,500	3,600	90,000	500	95,600
Total	14,700	36,300	502,000	10,800	563,800

The manual contains a chapter devoted to combustion and fuels which includes a chart (Fig. 2) giving the quantities of coal and oil required for steam heating systems operating under various overall efficiencies. Another chapter is devoted to the calculation of heat transmission much of which is based on a tentative code of the American Society of Heating and Ventilating Engineers, now being compiled.

Gas-fired warm-air heating systems are discussed with many detailed views of typical installations, including systems equipped with auxiliary fans for accelerating air circulation.

Under gas-fired steam and water heating systems the various arrangements in common use are shown as supplied from a gas-heated boiler. Instructions for installing gas-fired boilers are included as well as for converting coal boilers to gas. On this point the manual states that gas boilers which are built in vertical sections, make very long boilers in all but the smallest sizes, and that in such construction

priming and wet steam are likely to occur unless the basement main runs to a looped boiler connection.

The pressure drop from the street service to the boiler must be reduced to a minimum. In other words, the gas pressure at the boiler should be as close as possible to the street service pressure. This means piping large enough to supply the requisite amount of gas, a meter capable of passing the gas at the maximum rate (particularly where the boiler is not separately metered) without more than ½-in. pressure drop, and as few bends and fittings as practical.

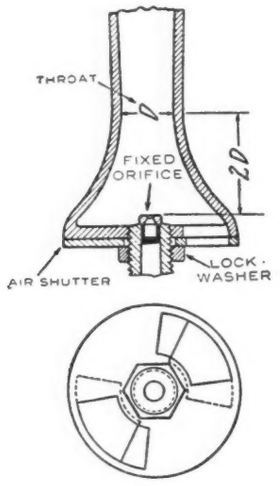

Fig. 3.—Typical Arrangement of Air Mixer at Burner

As pressure variations occur in the service over wide limits, the boiler should be adjusted to operate at its rated capacity when the pressure is at a minimum. That is, by means of the boiler gas governor, the pressure should be cut down to the expected minimum values in the service and then gas orifices drilled large enough to supply gas at the rated capacity at the minimum pressure, should be fitted into the burner cock. The advantage of this method of adjustment is in the certainty of continuous performance at the guaranteed rating of a boiler under conditions of varying pressure. Moreover, if the boiler is adjusted at the average pressure valve, trouble from flash back and carbonization is likely to occur when the pressure reaches a low value.

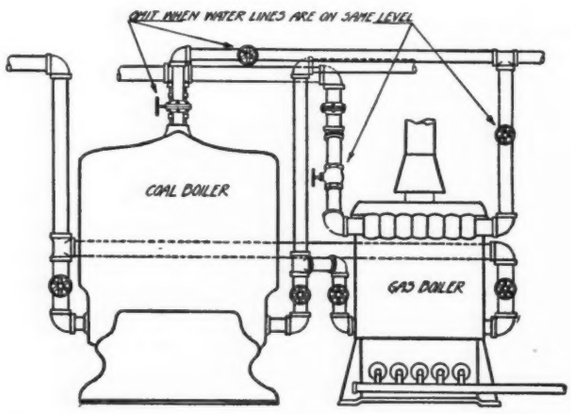

Fig. 4.—Cross-Connecting Water Boilers

BURNER ADJUSTMENT

After the boiler is installed, and water supplied so that in the case of a steam boiler it will be filled to the water line and in the case of a hot-water boiler it will be filled until the expansion tank overflows, and the burners connected to a gas line of ample capacity, then the burners must be lighted and adjusted. Proper combustion is indicated when the flame is sharp and firm, with a well-defined inner blue cone and no trace of yellow. It must not be so sharp, however, that it ignites or extinguishes with undue noise or flashes back into the mixing chamber. If the burners have flashed back and have operated in that condition for any length of time it will be necessary to take them out and carefully clean them. It is sometimes necessary to dig the hard carbon deposit out of the burner ports with drills of the same size as the original port.

While the flame must not be too hard, avoid, on the other hand, using lazy, floating or yellow-tipped flames since they cause odors, deposit soot and waste gas.

The various parts of an air mixer are shown in Fig. 3. Flame adjustment is made by turning the air shutter to admit more air if the flame is lazy and less air if the flame is too sharp.

Should air adjustment fail to produce efficient and proper combustion the size of the orifices must be changed as follows:—

(a) A burner with air shutter wide open, producing a yellow flame, requires a smaller size orifice.

(b) A burner that flashes back with air shutter almost closed, required a larger size orifice.

CROSS CONNECTING COAL AND GAS BOILERS

Quite frequently, when a customer has already a coal boiler in his home, it is desirable to leave the coal boiler in place, and to cross connect the gas boiler with it. For small gas companies or any others where there is any possible chance of a shortage or failure of gas, it would seem to be good practice to encourage cross connecting as the customer would realize very little for a second-hand coal boiler, and it is worth more to him as a safeguard against

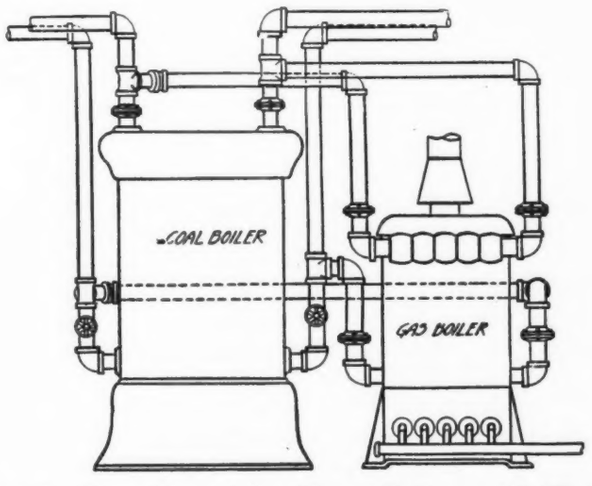

Fig. 5.—Cross-Connecting Steam Boilers with Water Lines Not on Same Level

failure of his gas system than he would realize by selling it. It also produces a more secure feeling in the customer's mind when putting in gas-fired house-heating equipment, if he knows that he can burn coal at any time he has occasion to. He then feels that he is not at the mercy of the gas company if the rates should be changed. There is almost no difference in the cost of an installation, whether it is cross-connected or displaced. Cross connection also gives the customer a means of disposing of papers, crating material, etc.

In water heating systems, it is necessary to valve off the return pipes on the coal boiler, which prevents circulation through the latter when the gas boiler is in use. Since the gas boiler holds comparatively little water and is almost always insulated, no valves are needed on the return pipes to the gas boiler. Hence, by opening the valves on the coal

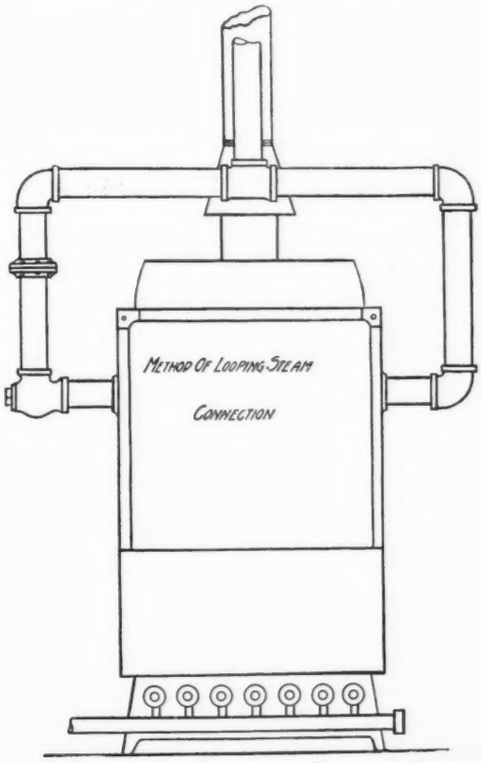

Fig. 6.—Method of Looping Steam Connection in Vertical-Section Boiler to Prevent Priming and Wet Steam

boiler, it may be operated independently or in conjunction with the gas boiler.

For steam or vapor installation, it is necessary to valve off all of the returns and flows on each boiler unless the gas boiler is set so that the water-line in both boilers is at the same level, in which case it is necessary to valve off only the local boiler to prevent the heating of the water in the coal boiler when it is not in use. See Fig. 4 and 5.

The gas boiler should be set as close to the coal boiler as practicable, and the flows and returns should cut into the flows and returns of the coal boiler as near to the latter as possible.

AGAINST CONVERSION OF COAL BOILERS

The manual takes a stand against the conversion of coal boilers to gas. Conversion, it is stated, is at best a makeshift and involves the following inherent defects:

1. Coal boilers require a strong draft which is too great for gas burners so that the stack losses are very high unless suitable baffling is introduced. Such baffling may interfere, with the perfect combustion of the gas and in any event involve structural difficulties. The well-designed gas boiler has a length of heat travel properly proportioned to the volume and temperature of the flue products so as to extract the maximum amount of heat.

2. A large part of the heat from a coal bed passes directly as radiant heat into the boiler. A gas flame has little radiating power so that additional heating surface is required for the same rate of absorption. (The gas flues can be much smaller, however, making a gas boiler smaller and lighter than a coal boiler of equivalent rating). Brick checkerwork can be inserted but then the economy of operation under light loads is materially reduced on account of the heat capacity of the brick. The well-designed gas boiler does not depend on radiant heat and operates efficiently at all loads with a minimum standby loss.

THERMOSTATIC CONTROL

The importance of thermostats is emphasized as a means of offsetting the additional expense of gas in house-heating. Thermostats for this work are divided into two classes depending on whether they operate the main gas valve of the boiler or the individual radiator valves. The former group, sometimes termed the unit system, is for use in residences where the temperature of the building can be satisfactorily maintained the same throughout. The individual system is for use in large buildings, offices, apartment houses, or factories. Notes are included in the manual on the location of unit system thermostats.

The following locations are mentioned as giving unsatisfactory results and customers are discouraged from their use.

1.—Corner recess or alcove.

2.—Hallways which are exposed to stairway drafts and door drafts.

3.—Kitchen.

4.—Bedrooms.

5.—In warm-air furnace heating systems avoid locations near the cold air return grille or warm air register.

6.—Customers occasionally wish to have the thermostats sealed, but to do so invites failure.

The question of location is further affected by the amount of radiation in the room, either over-radiation or under-radiation making such a room undesirable for the installation of the thermostat.

Under chimneys and flues, emphasis is laid on the need of securing the best possible draft.

A concluding chapter of the manual contains a standard code for testing and rating gas-fired steam boilers. Under "Service" some timely rules are given on the operation and care of gas-fired steam and water boilers.

This is the second lesson of

The Heating and Ventilating Magazine's

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This course is open only to subscribers of THE HEATING AND VENTILATING MAGAZINE. The first lesson appeared last month, but you can commence the course any time. As soon as you enroll you will receive the Work Problems pertaining to Lesson 1. Full directions will be given where to send your solutions of the Work Problems.

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Home-Study Course in Gravity Steam and Water Heating

Lesson No. 2 B. T. U. Basis of Figuring Heat Losses

LET US assume that the cross-hatched part of Fig. 3 represents a section of a hollow receptacle, cubical in shape. All six walls of this cube are assumed equally thick and impervious to heat, that is, regardless of how much or how little heat might be impounded within this hollow part, the walls are of such a character that none can escape. (This is a purely theoretical assumption since no material substance possesses this property.)

This hollow cube would then represent a container in which a quantity of heat might be retained indefinitely so that it would be necessary only once to supply the required number of heat units to assure maintaining the desired temperature within.

Practically, however since all substances permit heat to pass through them to a greater or less degree depending upon their density, thickness and the temperature existing on the two sides of the substance, it is necessary, in order to maintain a desired temperature within an enclosure continually to supply heat by an amount equal to that which the material permits to pass to the outside.

Referring again to Fig. 3, let us now assume that the cross-hatched part represents a room containing neither doors nor win-

(Do not fill in.) *Application for Enrollment for*

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(1) I hereby agree to pay a total of $80.00 for the complete course of instruction, assigned work, advice, and corrections of submitted work.

(2) If this application is accepted, I agree to pay the remaining balance, after deducting this first payment, in regular monthly installments amounting to not less than $10.00 monthly (commencing five days from the date of notification of the acceptance of this application) until the full amount has been paid.

(3) In consideration of the payments above specified, it is understood that I am to be supplied with text assignments as published monthly in THE HEATING AND VENTILATING MAGAZINE; work problems, additional tables and all matter that constitutes the course, by mail direct from the A-Em-Dee Engineering Company.

(4) If this application is not accepted, it is understood that the enclosed remittance is to be returned to me.

(5) If, in the judgment of the A-Em-Dee Engineering Company, my submitted work indicates lack of adaptability to the course, it is understood that upon notification, my status as a student shall terminate and I shall pay for only such text, prints, etc., as may have been sent me.

(6) I agree on my part to prosecute the work energetically, to devote regular time to study (in so far as may be possible) and to complete it without delay unless interference is caused by sickness or other unavoidable causes.

Name.....

Address.....

Date..... Accepted.....

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lows with inside length 10 ft., breadth 10 ft. and ceiling height above floor 10 ft. We will assume that each of the walls are built of brick, 12 inches thick, that the floor is constructed of 4 in. of concrete laid on the ground and that the ceiling is composed of lath and plaster.

We will now build around this imaginary room another enclosure such as is indicated by walls E and locate this outer enclosure so that the volume of the space L enclosed between these two hollow cubes will be equal to that contained within the smaller, noted as K. We will assume that the walls, bottom and top of the outer inclosure are impervious to the transfer of heat and that heat may pass through the walls, roof and ceiling of the inner room if conditions are favorable to such movement.

If we now introduce into space K just sufficient heat to establish a temperature of 100° F. in this inner space while a temperature of 0° F. exists in the space L, and then observe the result. We would find that heat would pass from the warmer to the cooler space with a consequent lowering of the temperature in K and a raising of the temperature in L, until these two temperatures are equal or reach 50° F.

The heat thus lost by space K and gained by space L passed through the walls, floor and ceiling of the inner room. This is exactly how heat is "lost" in the case of a residence, except that there is no outer wall impervious to heat transfer, as E,

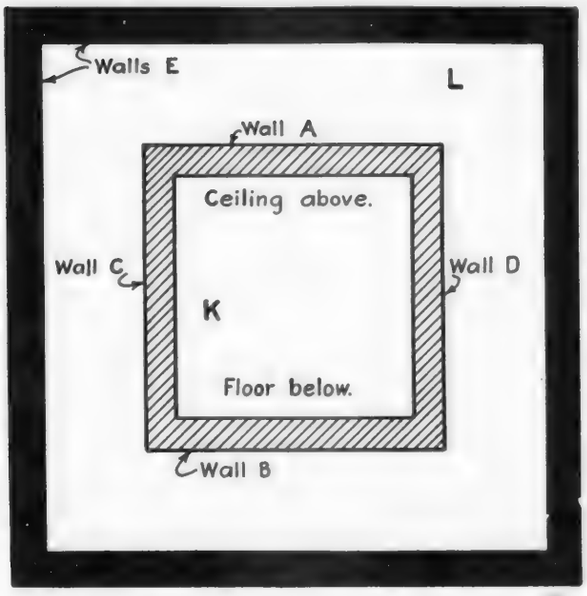


Fig. 3.—A Cubical Enclosure for Illustrating Heat Loss

so that to maintain a desired temperature within a structure it is necessary to supply heat units continuously since those that pass to the outside are wholly insignificant so far as having any effect upon raising the outside temperature. To all practical purposes they represent "lost heat."

To determine the quantity of heat that must be continuously supplied for a particular case it is necessary to consider the type of construction of which the walls, floors and ceiling are composed. This has a decided influence upon heat loss.

Experiments have been conducted to determine the quantity of heat that will pass through different types of walls, floors, roofs, ceilings, windows, doors and partitions, for 1° difference in temperature on the two sides of the wall. While different investigators have determined slightly different values, owing to minor variations in the compositions of materials or methods used, in general, results substantially agree.

For the purpose of uniformity in this course and to acquaint the student who is just entering the heating and ventilating profession with the use of such tables all necessary data of this kind are included and the student will be expected to use them in his solutions of the assigned problems. Tables 4 to 12 inclusive containing heat transmission values for various types of construction are presented with this lesson. The student should carefully study these tables and familiarize himself with their contents. Each table contains a description of a type of construction, together with a value for that construction. This value under B.T.U. in each table expresses the quantity of heat that will be transmitted per degree difference in temperature per hour per square foot of surface.

Work Problem No. 22

HEAT LOSS FROM WALL OF UNIFORM CONSTRUCTION

Let it be required to calculate the heat loss per hour from a plain brick wall 16 ft. long by 12 ft. high by 16 in. thick when the temperature on one side is maintained at 70° F. and on the other side at 0° F. Proceed as follows:

Area of wall = 16 ft. x 12 ft. =192 sq. ft.

Heat loss per hour per square foot per degree F. temperature difference (by Table 4) = 0.25 B.T.U.

Total temperature difference = 70°—0° = 70° F.

Total hourly heat loss = $192 \times 70 \times 0.25 = 3360$ B.T.U.

Work Problem No. 23

EFFECT OF TYPE OF CONSTRUCTION ON HEAT LOSS

An approximate comparison of the effectiveness of different types of construction as regards heat loss therefrom may be obtained by comparing their transmission factors. Thus the heat loss through a frame wall built of clapboards on studs (see Table 5) as compared to a plain brick wall 12 in. thick (see Table 4) is as 0.62 is to 0.29, or the loss through the frame wall will be more than twice that through the brick wall. Therefore, more than twice as much heat would need to be supplied to a room built of clapboards on studs as if the walls were of plain brick 12 in. thick.

Work Problems Nos. 24 and 25

The heating and ventilating engineer is usually called upon to prepare his design from submitted

blue prints. It is necessary therefore to take dimensions from the blue print or to scale it. In Fig. 4 portions of two walls are shown for which the heat loss in B.T.U. are to be calculated.

Work Problems Nos. 26, 27 and 28

HEAT LOSS FROM WALLS CONTAINING WINDOWS AND DOORS

Thus far we have considered walls of continuous construction to demonstrate heat loss principles involved. We will now consider walls which contain window and door openings and will see that such openings have a marked effect on the heat requirements of a given room.

In Fig. 5 is illustrated a plan of a room having three outside windows and one outside door. The room is 14 ft. long, 10 ft. wide and has a ceiling height of 9 ft. The outside door is 3 ft. by 7 ft. and each of the windows is 2 ft. wide x 4 ft. 6 in. high. We desire to know how many heat units will be required to maintain a temperature of 70° F. within space K when the outside temperature is 0° F. It will be assumed that inside spaces M. and N. adjoining K, are to be maintained at the same temperature as K by some other source of heat supply and that the spaces directly below and above are also heated to this same temperature of 70° F. These assumptions immediately eliminate consideration of loss of heat through the inner walls, floor or ceiling and limit our problem to that of determining the losses through the west and north wall.

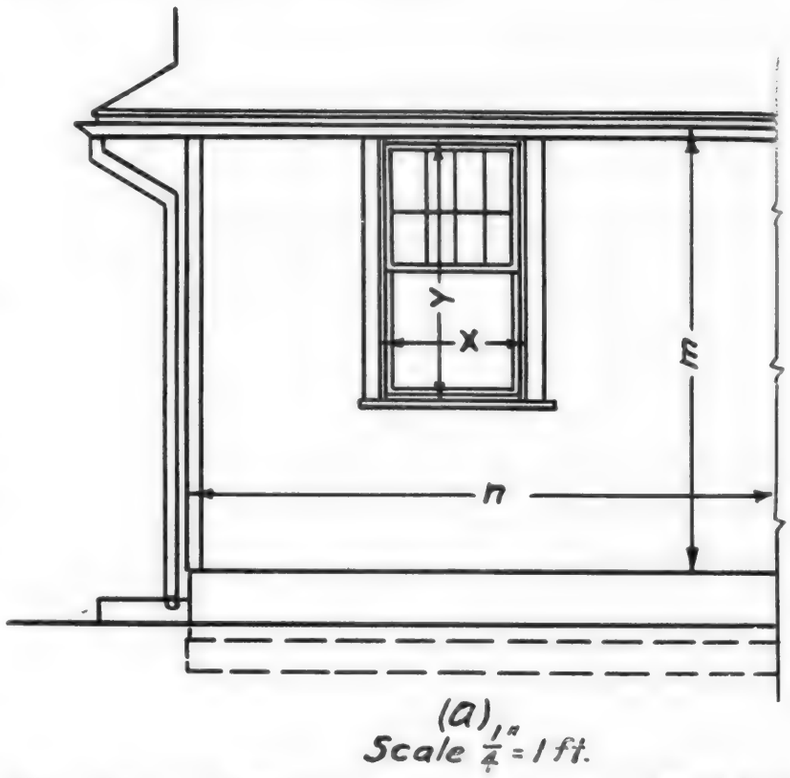


Fig. 4. Parts of Walls for Problems Relating to Heat Loss

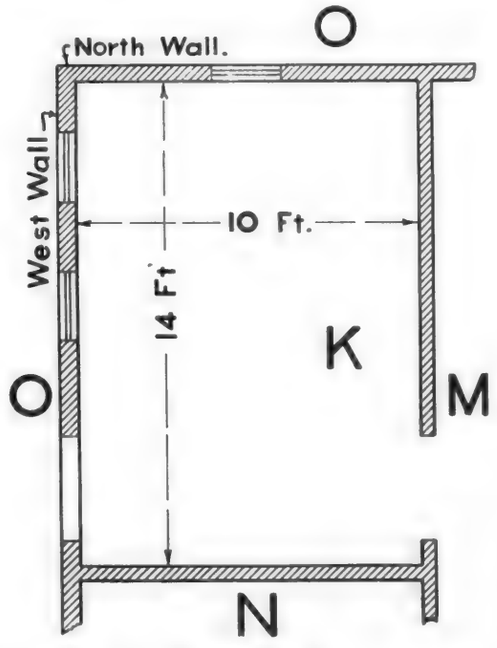


Fig. 5. A Room with Two Exposures for Which Heat Loss Calculations Are Required in Problems Involving Exposure

The outside or exposed walls as they are commonly called are considered to be constructed of brick 16 in. thick, plastered on the inside. We will first determine the outside areas of the walls, windows and door through which heat will be conducted. The gross area of each wall is:

North wall, 10 ft. (length) x 9 ft. (height) = 90 sq. ft.
West wall, 14 ft. (length) x 9 ft. (height) = 126 sq. ft.

In the north wall there is one window 2 ft. wide x 4½ ft. high, with area of 9 sq. ft. The window and door sizes should always be taken as equal to the gross opening in the wall. In the west wall there are two windows of the same size as in the north wall and one door 3 ft. x 7 ft., with a total combined window and door area of 39 sq. ft. Deducting these areas from the above gross wall areas, the net wall area is obtained as follows:

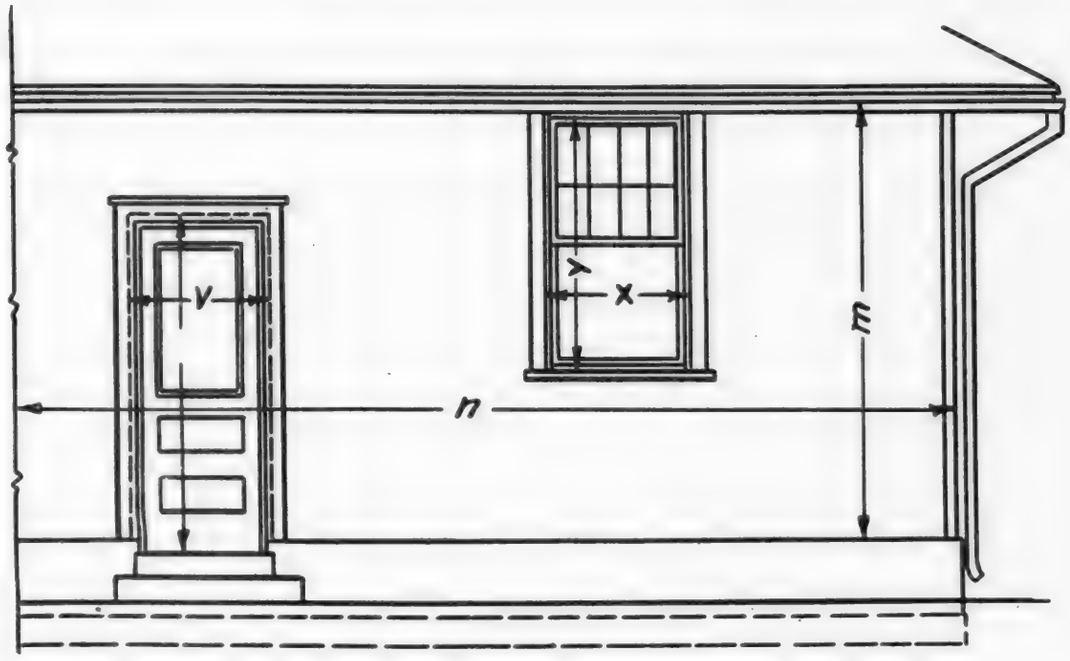
Net area of north wall= 90 sq. ft.— 9 sq. ft.=81 sq. ft.
Net area of west wall=126 sq. ft.—39 sq. ft.=87 sq. ft.

The heat transmission coefficient for this type of wall by Table 4 is 0.24. The heat loss through each wall may be calculated as follows:

	Area	Temp. Diff.		Per Hour
For north wall—	81 sq. ft.	x 70°	x 0.24 B.T.U.	=1361 B.T.U.
For west wall—	87 sq. ft.	x 70°	x 0.24 B.T.U.	=1462 B.T.U.

By Table 9, the transmission factor for a window of single-thickness glass in a wooden frame is 1.10 B.T.U. The heat loss through the windows will then be:

	Area	Temp. Diff.		Per Hour
For north window—	9 sq. ft.	x 70°	x 1.10 B.T.U.	= 693 B.T.U.
For west window—	18 sq. ft.	x 70°	x 1.10 B.T.U.	=1386 B.T.U.



(b)
Scale $\frac{1}{4}$" - 1 ft.

Fig. 4 (Cont'd).—Parts of Walls for Problems Relating to Heat Loss

By Table 10, the transmission factor for a wooden door 1¼ in. thick is 0.60 B.T.U. The heat loss through the door in the west wall will then be:

Area		Temp. Diff.				Per Hour
21 sq. ft.	x	70°	x	0.60 B.T.U.	=	882 B.T.U.

The total heat loss for this room in B.T.U. per hour for the conditions as stated will be:

From walls, north.....	1361
From walls, west.....	1462
From windows, north.....	693
From windows, west.....	1386
From door, west.....	882
	5784

Work Problem No. 29

The following eight-step form should be used in submitting solutions for problems involving the calculation of the total heat loss from a wall containing window and door openings.

First: Calculate in square feet, the gross exposed wall area (that is, include all openings).

Second: Calculate in square feet, the area of each opening.

Third: Subtract result Second from result First and obtain the Net Wall Area.

Fourth: Select from proper tables, the proper heat transmission factor for the type of wall and openings.

Fifth: Subtract the outside temperature from the inside temperature.

Sixth: Multiply the Net Wall Area found in Third by the transmission factor from Fourth and this product by result Fifth and obtain the heat loss per hour in B.T.U. for the wall.

Seventh: Multiply the Area of each opening (or combined) found in Second by the proper transmission factor from Fourth and this product by the result Fifth and obtain heat loss per hour in B.T.U. for each opening (or total).

Eighth: Add results Sixth and Seventh and obtain the total heat loss from the wall in B.T.U.

Work Problems Nos. 30, 31 and 32

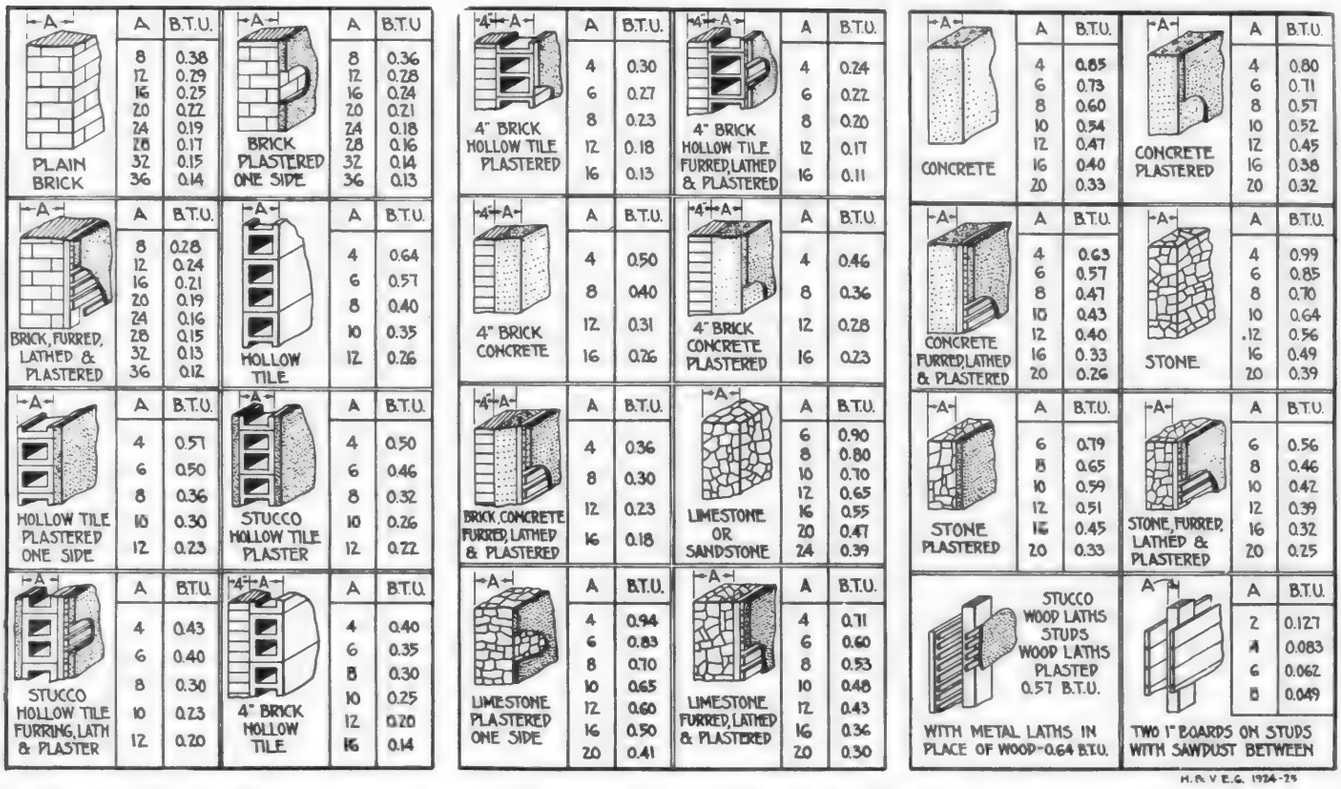
EFFECT OF EXPOSURE

Exposure is an important factor. It may carry much weight when applied to calculations for one room such as we have just been considering. But when considered for an entire house, its effect may be multiplied many times.

Reference to Fig. 6 will assist toward a clearer conception of this factor. Here are shown two ground plans; A, representing a square type, with B representing a spread-out type. The area of A is equal to that of B; each representing 1296 sq. ft., so, for the same ceiling heights, the cubical contents will be equal. But the running feet of exposure is 144 ft. for A, while B has 178 ft. or an increase of 26.4%. It is essential therefore that consideration be given exposure.

In this hemisphere, the south side of a house upon which the sun shines, will show during the day, an average temperature higher than on the north side. This fact is called Exposure, and should properly be taken into consideration in calculating heat losses, for when the north and west wall surfaces of a building are subjected to heavy winds and low tem-

TABLE 4. HEAT TRANSMISSION FROM VARIOUS TYPES OF WALL CONSTRUCTION



PLAIN BRICK			BRICK PLASTERED ONE SIDE		
A	A	B.T.U.	A	A	B.T.U.
4"	8	0.38	4"	8	0.36
	12	0.29		12	0.28
	16	0.25		16	0.24
	20	0.22		20	0.21
	24	0.19		24	0.18
	28	0.17		28	0.16
	32	0.15		32	0.14
	36	0.14		36	0.13

BRICK, FURRED, LATHED & PLASTERED			HOLLOW TILE		
A	A	B.T.U.	A	A	B.T.U.
4"	8	0.28	4"	4	0.64
	12	0.24		6	0.57
	16	0.21		8	0.40
	20	0.19		10	0.35
	24	0.16		12	0.26
	28	0.15			
	32	0.13			
	36	0.12			

HOLLOW TILE PLASTERED ONE SIDE			STUCCO HOLLOW TILE PLASTER		
A	A	B.T.U.	A	A	B.T.U.
4"	4	0.57	4"	4	0.50
	6	0.50		6	0.46
	8	0.36		8	0.32
	10	0.30		10	0.26
	12	0.23		12	0.22

STUCCO HOLLOW TILE FURRING, LATH & PLASTER			4" BRICK HOLLOW TILE		
A	A	B.T.U.	4"	A	B.T.U.
4"	4	0.43		4	0.40
	6	0.40		6	0.35
	8	0.30		8	0.30
	10	0.23		10	0.25
	12	0.20		12	0.20
				16	0.14

4" BRICK HOLLOW TILE FURRED, LATHED & PLASTERED			4" BRICK CONCRETE		
4"	A	B.T.U.	4"	A	B.T.U.
	4	0.30		4	0.50
	6	0.27		8	0.40
	8	0.23		12	0.31
	12	0.18		16	0.26
	16	0.13			

4" BRICK CONCRETE PLASTERED			BRICK, CONCRETE FURRED, LATHED & PLASTERED		
4"	A	B.T.U.	4"	A	B.T.U.
	4	0.46		4	0.36
	8	0.36		8	0.30
	12	0.28		12	0.23
	16	0.23		16	0.18

LIMESTONE OR SANDSTONE			LIMESTONE PLASTERED ONE SIDE		
A	A	B.T.U.	A	A	B.T.U.
6"	6	0.90	4"	4	0.94
	8	0.80		6	0.83
	10	0.70		8	0.70
	12	0.65		10	0.65
	16	0.55		12	0.60
	20	0.47		16	0.50
	24	0.39		20	0.41

LIMESTONE FURRED, LATHED & PLASTERED		
A	A	B.T.U.
4"	4	0.71
	6	0.60
	8	0.53
	10	0.48
	12	0.43
	16	0.36
	20	0.30

CONCRETE			CONCRETE PLASTERED		
A	A	B.T.U.	A	A	B.T.U.
4"	4	0.85	4"	4	0.80
	6	0.73		6	0.71
	8	0.60		8	0.57
	10	0.54		10	0.52
	12	0.47		12	0.45
	16	0.40		16	0.38
	20	0.33		20	0.32

CONCRETE FURRED, LATHED & PLASTERED			STONE		
A	A	B.T.U.	A	A	B.T.U.
4"	4	0.63	4"	4	0.99
	6	0.57		6	0.85
	8	0.47		8	0.70
	10	0.43		10	0.64
	12	0.40		12	0.56
	16	0.33		16	0.49
	20	0.26		20	0.39

STONE PLASTERED			STONE, FURRED, LATHED & PLASTERED		
A	A	B.T.U.	A	A	B.T.U.
6"	6	0.79	6"	6	0.56
	8	0.65		8	0.46
	10	0.59		10	0.42
	12	0.51		12	0.39
	16	0.45		16	0.32
	20	0.33		20	0.25

WITH METAL LATHS IN PLACE OF WOOD - 0.64 B.T.U.	STUCCO WOOD LATHS STUDS WOOD LATHS PLASTER 0.57 B.T.U.		TWO 1" BOARDS ON STUDS WITH SAWDUST BETWEEN		
	A	B.T.U.	A	A	B.T.U.
	2"	0.127		2"	0.127
	4"	0.083		4"	0.083
	6"	0.062		6"	0.062
	8"	0.049		8"	0.049

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TABLE 12. HEAT TRANSMISSION FROM INTERIOR WALLS

CONSTRUCTION	B.T.U.
PLASTER, LATH, STUDS, LATH AND PLASTER	0.34
STUDS, LATH AND PLASTER	0.60
4" HOLLOW TILE, PLASTERED 1 SIDE	0.57
4" HOLLOW TILE, PLASTERED BOTH SIDES	0.50
2" GYPSUM BLOCK, PLASTERED 1 SIDE	0.64
2" GYPSUM BLOCK, PLASTERED BOTH SIDES	0.60

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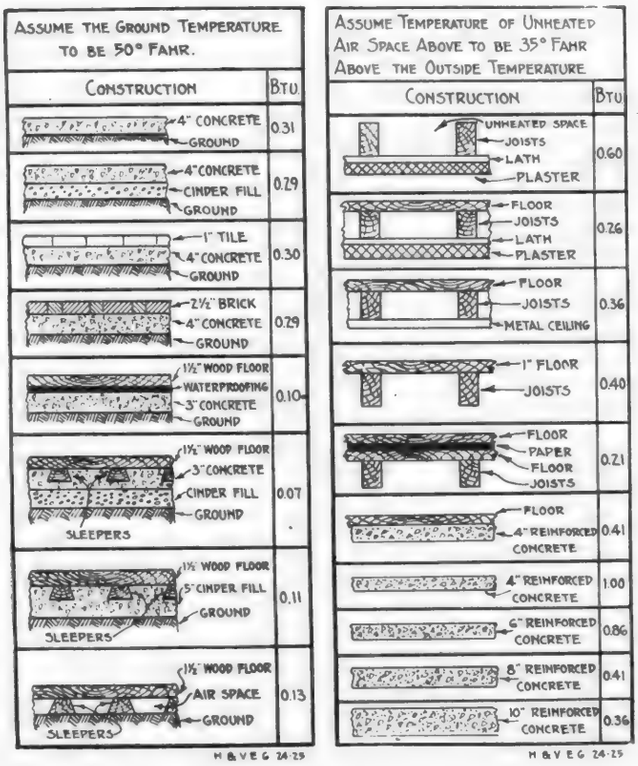
TABLES 6 AND 7. HEAT TRANSMISSION FROM FLOORS AND CEILINGS



ASSUME THE GROUND TEMPERATURE TO BE 50° FAHR.

CONSTRUCTION	B.T.U.
4" CONCRETE, GROUND	0.31
4" CONCRETE, CINDER FILL, GROUND	0.29
1" TILE, 4" CONCRETE, GROUND	0.30
2½" BRICK, 4" CONCRETE, GROUND	0.29
1½" WOOD FLOOR, WATERPROOFING, 3" CONCRETE, GROUND	0.10
1½" WOOD FLOOR, 3" CONCRETE, CINDER FILL, GROUND, SLEEPERS	0.07
1½ WOOD FLOOR, 5" CINDER FILL, GROUND, SLEEPERS	0.11
1½" WOOD FLOOR, AIR SPACE, GROUND, SLEEPERS	0.13

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ASSUME TEMPERATURE OF UNHEATED AIR SPACE ABOVE TO BE 35° FAHR ABOVE THE OUTSIDE TEMPERATURE.

CONSTRUCTION	B.T.U.
UNHEATED SPACE, JOISTS, LATH, PLASTER	0.60
FLOOR, JOISTS, LATH, PLASTER	0.26
FLOOR, JOISTS, METAL CEILING	0.36
1" FLOOR, JOISTS	0.40
FLOOR, PAPER, FLOOR, JOISTS	0.21
FLOOR, 4" REINFORCED CONCRETE	0.41
4" REINFORCED CONCRETE	1.00
6" REINFORCED CONCRETE	0.86
8" REINFORCED CONCRETE	0.41
10" REINFORCED CONCRETE	0.36

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TABLE 8. HEAT TRANSMISSION FROM ROOFS

CONSTRUCTION	B. T. U.
1" WOOD, 5 PLY PAPER, TAR AND GRAVEL	0.30
1" WOOD, FELT ROOFING	0.36
1½" WOOD, 5 PLY PAPER, TAR AND GRAVEL	0.26
2" WOOD, 5 PLY PAPER, TAR AND GRAVEL	0.21
2½" WOOD, 5 PLY PAPER, TAR AND GRAVEL	0.18
TIN ON WOOD STRIPS	1.60
TIN ON SHEATHING	0.60
TIN ON SHEATHING, WITH PAPER	0.43
SHINGLES ON WOOD STRIPS	0.87
SHINGLES ON SHEATHING	0.43
SHINGLES, PAPER, SHEATHING, STRIPS	0.21
4" HOLLOW TILE, PAPER, TAR AND GRAVEL	0.30
6" HOLLOW TILE, PAPER, TAR AND GRAVEL	0.27
2" CONCRETE, PAPER, TAR AND GRAVEL	0.71
3" CONCRETE, PAPER, TAR AND GRAVEL	0.64
4" CONCRETE, PAPER, TAR AND GRAVEL	0.57
FLAT TILE ON WOOD STRIPS	1.07
FLAT TILE ON SHEATHING	0.64
SLATE ON WOOD STRIPS	1.10
SLATE ON PAPER AND SHEATHING	0.50
CORRUGATED IRON ON STRIPS	1.50
CORRUGATED IRON, SHEATHING	0.64

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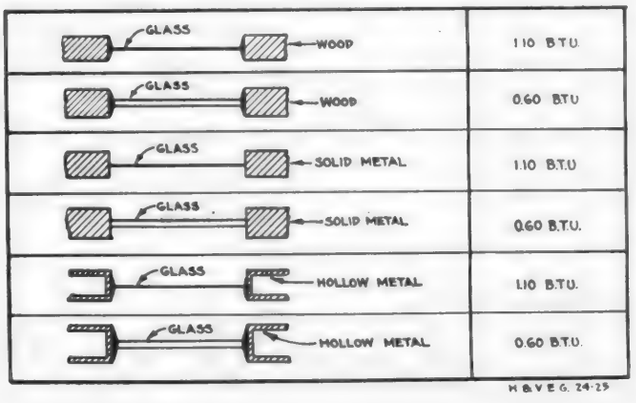
TABLE 9. HEAT TRANSMISSION FROM WINDOWS, ROOF GLASS, AND SKYLIGHT



GLASS, WOOD	1.10 B.T.U.
GLASS, WOOD	0.60 B.T.U.
GLASS, SOLID METAL	1.10 B.T.U.
GLASS, SOLID METAL	0.60 B.T.U.
GLASS, HOLLOW METAL	1.10 B.T.U.
GLASS, HOLLOW METAL	0.60 B.T.U.

H & V E G. 24-25

TABLE 10. HEAT TRANSMISSION FROM WOOD DOORS AND WOOD PARTITIONS

HEAT TRANSMISSION FROM WOOD DOORS & WOOD PARTITIONS	B.T.U.
¾" TO 1" THICK TONGUED AND GROOVED	0.65
1" TO 1¼" " " " "	0.60
1¼" TO 1½" " " " "	0.50
1½" TO 2" " " " "	0.42
2" TO 2½" " " " "	0.35
2½" TO 3" " " " "	0.30

H. & V. E. G. 24-29

TABLE 11. HEAT TRANSMISSION FROM WALLS OF VARIOUS CONSTRUCTION

THICKNESS OF BOARD IN INS.	TWO BOARDS WITH PAPER BETWEEN	BOARD & CORRUGATED IRON	BOARD & SHEET IRON
½"	0.32 B.T.U.	0.45 B.T.U.	0.50 B.T.U.
1"	0.24 B.T.U.	0.36 B.T.U.	0.40 B.T.U.
1½"	0.19 B.T.U.	0.30 B.T.U.	0.33 B.T.U.
2"	0.16 B.T.U.	0.26 B.T.U.	0.28 B.T.U.
2½	0.14 B.T.U.	0.23 B.T.U.	0.25 B.T.U.

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TABLE 5. HEAT TRANSMISSION FROM WALLS OF CLAPBOARD CONSTRUCTION

CONSTRUCTION	B.T.U.
CLAPBOARD ON STUDS	0.62
CLAPBOARD ON STUDS, LATH AND PLASTER	0.48
CLAPBOARD, PAPER, STUDS, LATH AND PLASTER	0.34
CLAPBOARD, STUDS, 1" SHEATHING	0.57
CLAPBOARD, SHEATHING, STUDS, LATH AND PLASTER	0.37
CLAPBOARD, PAPER, SHEATHING, STUDS, LATH AND PLASTER	0.30
CLAPBOARD, STUDS, BRICK FILL	0.40
CLAPBOARD, STUDS, BRICK FILL, PAPERED	0.36
CLAPBOARD, STUDS, BRICK FILL, LATH AND PLASTER	0.31
CLAPBOARD, SHEATHING STUDS, LATH AND PLASTER WITH SAWDUST FILL	0.21
CLAPBOARD, PAPER, SHEATHING, STUDS, LATH AND PLASTER WITH SAWDUST FILL	0.15

H. & V. E. G. 24-29

TABLE 13—EXPOSURE FACTORS*

Buildings well-constructed and subjected to only reasonable exposure.			Poorly-constructed; or well-constructed building subjected to high winds and low temperatures.	
For unventilated room, increase heat loss by per cent. below.	For ventilated room, increase heat loss by per cent. below.	Exposure	For unventilated room, increase heat loss by per cent. below.	For ventilated room, increase heat loss by per cent. below.
15	25	North	25	35
10	20	West	20	30
10	20	East	20	30
0	10	South	10	20

* The factors given are not based on experimental research, but are considered safe to use to assure ample heat supply when needed. Geographical location should be taken into consideration when applying them. In the warmer sections of the United States the factors might very properly be reduced one-half.

peratures, the amount of cold air leaking in through the wall, and the amount of heat carried away by the increased air currents brushing against the outside walls, will be materially increased.

It is difficult to give concrete data that could be applied with absolute accuracy, so it is the practice of many engineers to increase the calculated heat transmission loss of the wall and glass surface by a certain percentage in all cases. If buildings are well-constructed, and located so as to be subjected to only reasonable exposure, that is, so situated that they are somewhat protected from high winds by the proximity of other buildings, the exposure factors may be lower than for buildings that are

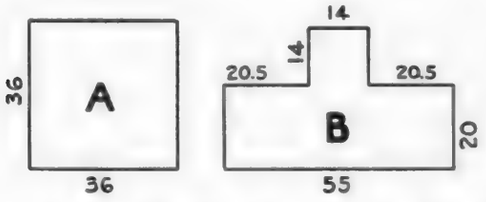

Fig. 6. Houses with the Same Ground Area but with Different Exposed Area Will Have Different Heat Requirements

located in the open where high winds are of frequent occurrence during the winter months.

Then again, if provision is made to ventilate the room, the factors should be higher than where no special means are provided for introducing fresh air continuously. A study of data in Table 13 and application of the data to the room shown as Fig. 5 should make this subject clear.

The room of Fig. 5 has a north and west exposure. We will assume that it is part of a well-constructed building standing in the open, no special means being provided for ventilation other than the ordinary leakage around windows and doors (which is covered below) and that obtained by opening of the door. The heat loss calculations should then be increased by 25% for the north wall and 20% for the west wall, taken from Table 13, which will give the following:

	Per Hour
For north wall (1361 + 693) x 1.25	= 2568 B.T.U.
For west wall (1462 + 1386 + 882) x 1.20	= 4476 B.T.U.
Total heat loss	= 7044 B.T.U

Thus, by considering the effect of exposure upon the heat requirements, we must supply 7044 B.T.U. per hour instead of 5784 B.T.U. per hour. A design based on the larger figure is just that much safer than that in which exposure is not considered.

Work Problems Nos. 33, 34, 35 and 36

Lesson No. 3, to appear next month, will cover the systematized method and application of the B.T.U. method of making heat calculations, specific heat of substances and the application of values to practical problems, the heat requirements of buildings that are intermittently warmed and the effect of such requirements upon the size of the heating plant, and the effect of infiltration on heating requirements.

Back To First Principles

Plain Answers to Direct Questions on Present-Day Heating and Ventilating Practice

By T. W. Reynolds

(*Continued from the October issue*)

44. What troubles may be expected from bull-head tees and connections? (*Continued from last issue*).

In water heating a more even distribution of the flow may be obtained by using double-branch elbows where the mains divide (See Fig. 33). Also, where two water radiators are connected together, the connections may be arranged as shown in Fig. 34, the larger radiator being favored by connection at the top.

Sometimes special tees known as "O. S. Fittings" (See Fig. 35) are used in lieu of the above connections. These tees are especially designed for distributing tees, being arranged with a deflector so as to favor the flow to the outlet of the tee. Such fittings are superior to the ordinary pipe connections and are cheaper to install.

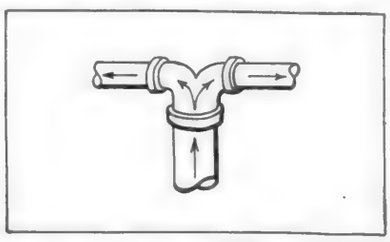

Fig. 33. Double Branch Elbows for Use Where Mains Divide.

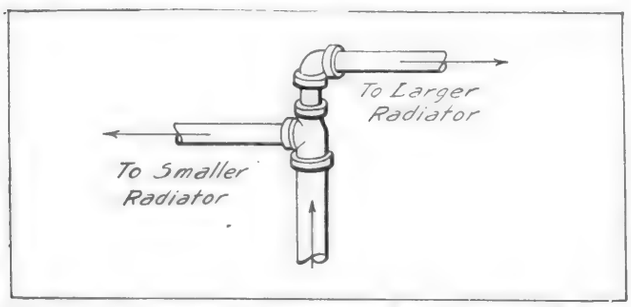

Fig. 34. Proper Connections for Large and Small Radiators When Jointly Supplied.

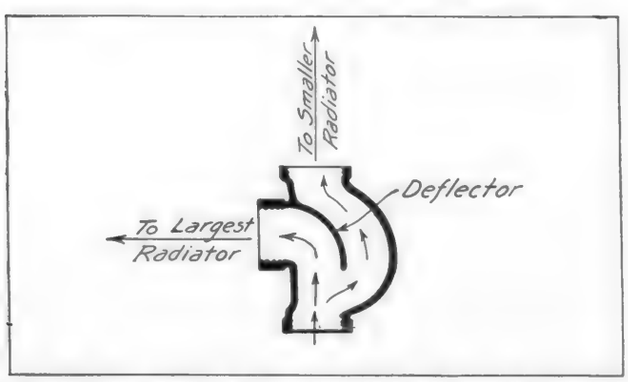

Fig. 35. Special Distributing Tees for Directing Flow of Hot Water to the Less Favored Radiators.

Cases of bull-head connections often encountered in heating work are interesting as they are quite often the cause of trouble. One such connection is shown in Fig. 36. This was in a smoke flue where the head-on collision of gases, together with the reduction in area caused by the eddies at the abrupt or right-angle turns caused a loss of draft. When corrected shown at "C" Fig. 37 the boiler capacity was very much increased. With the dotted line at "A" extended to "B," the capacity was still further increased. Connections like this are occasionally made, yet one would not think of setting two fans to blow against one another.

Similar conditions and correction by means of a baffle placed in a chimney is illustrated in Fig. 38, the flue gases being deflected into parallel streams. A good arrangement for two boilers discharging into a common stack is also shown in Fig. 38, the gases being directed into the path they are to go.

In fan work the same troubles are often encountered due to the same cause of bull-head connections in the ducts. Fig. 39 illustrates the point, the sketch at the left shows troublesome eddies, the one at the right uninterrupted stream flow of air. The latter is the proper method, using a deflecting plate as shown at "A." About the same method should be followed in steam heating and in gravity

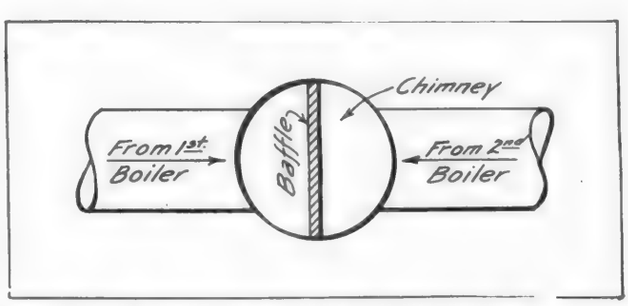

Fig. 36. A Smoke Flue With Bull-Head Connections.

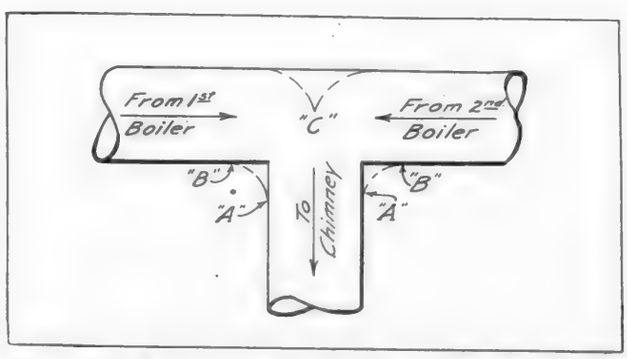

Fig. 37. A Chimney Baffle For Eliminating Head-on Collision of Gases.

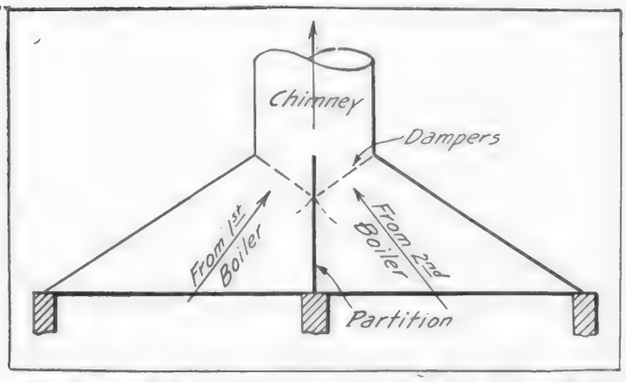

Fig. 38. A Good Arrangement for Two Boilers Discharging Into a Common Stack.

water heating, in particular for the latter as the motive head producing circulation of hot water is slight, even at the best, so that friction losses should be reduced.

WHY THE FIREPLACE SMOKED

45. *What is the cure for a smoky fireplace?*

An unusual chimney problem was encountered at a roadside inn where the fireplace had a way of smoking whenever a fire was built in it. The proprietors' statement that heating experts, even architects, had not been able to remedy the difficulty only served to add to the interest in the problem.

An inspection showed that the chimney was at least 2 ft. above the ridge of the peaked roof, so it was evident that nothing was wrong at this point. Not finding anything else which might cause a down draft, the cellar was visited. Here a flue opening was discovered stuffed with burlap. However, a lighted match held at the opening indicated no inward leakage, with or without the burlap stuffed in the opening, nor did the closure of either end of this flue (the other end terminated in the smoke chamber) help matters in the slightest.

The flue from the fireplace to the roof was then inspected, but instead of one flue, two were found, each 8 in. by 8 in. in size and placed together, giving, of course, more friction surface than if the two flues were united as one 8 in. by 16 in. flue. At first thought it would seem that down drafts from wind, or even cold air, might come down one of these flues while the gases went up the other. However, though this could very well happen with larger flues it would not be likely to take place with small flues of this size when connected with such a large

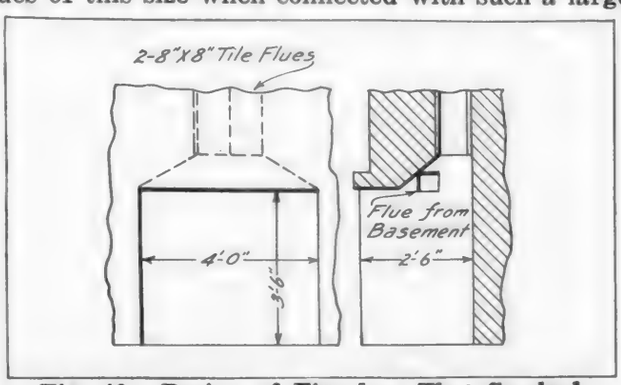

Fig. 40. Design of Fireplace That Smoked

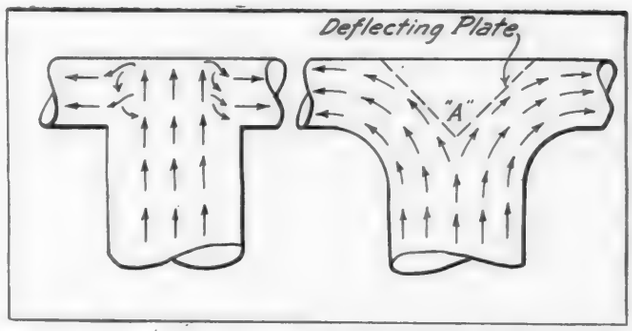

Fig. 39. Good and Bad Connections in Distributing Ducts.

fireplace opening. Finally the expedient was tried of holding some boards tight against the top of the fireplace opening. Instantly the smoke disappeared.

Ten to fifteen times the area of the fire opening, we know, should be the area of any fireplace opening, and eleven times would be about right in most cases. As related, this rule was demonstrated in a practical way by means of boards placed at the top of the fireplace so as to reduce the area of the fireplace opening. Boards at the sides would have helped also, but those at the top helped the most as the boards in this location prevented cold air from passing over the fire and killing the draft.

But even if this fireplace had been built as outlined, it still had little of merit in its design (See Fig. 40). Fig. 41 shows a better arrangement. The splayed jambs radiate heat into the room and present a pleasing appearance, the sloping back also adds to the appearance while producing a narrow throat and a wind-break of itself back of it. It is always well to remember that a fireplace should be at least 15 in. deep, 20 in. is better, and for very large fireplaces, 24 in. is not too deep, but more than that is unnecessary. Nor should the opening be more than 30 in. high, except for very wide fireplaces. A glance at the dimensions in the sketch (Fig. 40) will show how little attention had been given to such rules in the design of this fireplace.

Another point is that the smoke chamber should be drawn in at first toward the center of the chimney, otherwise the fire will burn in a one-sided manner, then it can be drawn over to which ever side the flue must pass up. The sides of the chamber should be reasonably smooth and all square angles or shoulders avoided, reducing gradually in area until it connects with the flue.

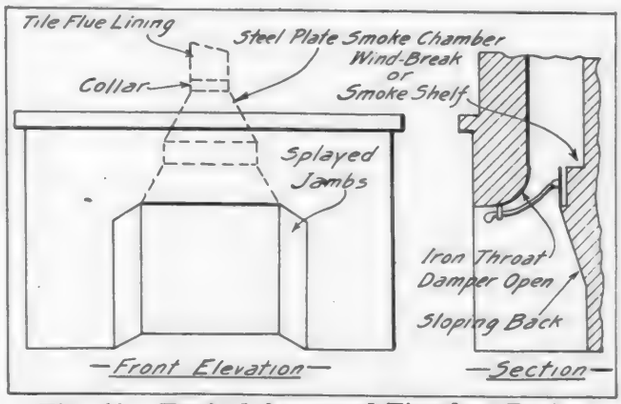

Fig. 41. Typical Approved Fireplace Design

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ON THE progress of builders during the inclement weather depends the work of heating men in installing temporary or permanent systems. In addition, extremely cold weather interferes with the actual work either through the human element or material conditions. For these reasons the heating and ventilating industry, along with the other divisions of the construction industry, is indebted to the Division of Building and Housing of the Department of Commerce for the information it has just published covering climatic conditions in nine construction centers. In compiling this information it was believed that weather tables showing average and extreme conditions over a sufficiently long period—ten years—would furnish a good basis on which architects and contractors could figure probable delays due to bad weather.

The three classes of cold days of an American winter were designated Class I, Class II and Class III. To Class I were assigned all those days on which the temperature went below 18° F. at some time and did not rise above 24° at any time; to Class II were assigned all days on which the temperature did not go below 18° and exceeded 25° at some time; to Class III were assigned the comparatively mild days on which the lowest temperature was between 25° and 32° F.

Nine cities were chosen for this study and the period from November to March, inclusive, was selected as the one for collecting temperature records, as freezing days outside that period are comparatively few. An analysis of the tables show that St. Paul leads in the number of Class I days, as might be expected from its northerly location. The average yearly number of such days is 58.6. Denver follows with 24.7. Then comes Chicago with 24.2, Boston with 20.3, St. Louis with 14.9, New York with 14.3, and Atlanta with 1.7. New Orleans and San Francisco have none. A noteworthy fact is that St. Louis leads New York in this severe weather by a small margin.

When the cities are grouped according to the number of Class II days St. Paul yields first place to Denver, which has 21.8. St. Paul has 19.9, Boston, 19.7; Chicago, 16.6; New York, 16.2; St. Louis, 12; Atlanta, 4.9; New Orleans, 0.2, and San Francisco, none.

Denver also has the greatest number of Class III days, 37.1. Then come New York with 33.4, Boston with 31.7, Chicago with 31.4, St. Louis with 29.3, St. Paul with 27.4, Atlanta with 15.4, New Orleans with 1.7, and San Francisco with none.

Totals of all three classes for each city place St. Paul in the lead with 105.9 freezing days. The maximum in any given year of the 10-year period was 115 in 1916-17, and the minimum was 98, in 1920-21. Denver has the next highest average number of freezing days, 83.6. Chicago follows with an average of 72.2, while the average of Boston is 71.7, New York, 63.9, St. Louis, 56.2; Atlanta, 22; New Orleans, 1.9; and San Francisco, none.

In compiling these figures the Department of Commerce has given a concrete example of its usefulness which will be appreciated by all construction interests. The figures should go far towards correcting the idea that construction is dependent upon favorable weather conditons to the extent that a slump in winter time is a normal and necessary thing.

ONE would think, from the activities of building congresses in different sections and the efforts of such organizations as the American Construction Council, that better conditions from a commercial standpoint would be bound to ensue in the heating industry. Yet the air is full of reports of commission cutting on the part of engineers, "loading" of jobs on the part of engineer-contractors and of abuses in the practice of free engineering on the part of the manufacturers. In Chicago the matter of free engineering has just been made the basis of an investigation by the Western Society of Engineers. If heating and ventilating engineering is to continue to justify itself as a distinct profession, it will have to conform sooner or later to the best standards of engineering practice and when an individual makes a habit of underbidding his fellow engineers in the matter of percentages for services, he is giving the profession a stab in the back which, if generally indulged in, would have the effect of wiping out, in short order, the very creditable place the profession has won for itself in the field of engineering.

American Society of Heating and Ventilating Engineers

Illinois Chapter's Views on Proposed A. S. H. & V. E. Heating and Ventilating Code

Some idea of difficulties still to be surmounted in the formulation of a code of minimum requirements for the heating and ventilating of buildings was brought out at a special code meeting of the chapter, October 27, and at the regular November meeting, held November 10 at the Chicago Engineers' Club. Practically the entire evening on each date was devoted to the proposed A. S. H. & V. E. heating and ventilating code, comments on the various sections being presented by different committees appointed especially for that purpose.

As a result of the discussions the chapter voted to have a committee draw up a resolution to be sent to the society urging that final adoption of the code be deferred and its text revised. E. Vernon Hill, Harry M. Hart and Samuel R. Lewis were named as the committee to draw up the proposed resolution.

At the October code meeting, the discussion was opened by Chairman Ernest F. Jones of the Committee on Section 3 (minimum requirements for estimating the heat required for warming buildings). Mr. Jones urged an additional 10° safety factor over the method of using temperatures as given in the government weather reports. He also urged the inclusion in the code of the heat loss tables published by THE HEATING AND VENTILATING MAGAZINE. A recommendation was made that the code and text book data be separated and that when published the code be in loose-leaf form to permit of corrections and additions whenever necessary. Co-operation was also urged with the National District Heating Association and with the Heating and Piping Contractors' National Association. In the discussion Mr. Hart suggested that the best parts of the society's methods and that of the heating contractors for determining wind velocity values be incorporated.

Chairman H. M. Hart reported on Section 6 (minimum capacity and installation requirements for low-pressure steam and water heating boilers). Among the points brought out were that the present method of flue sizing was objectionable and that a certain type of chimney for each type of building should be established. An illustration was the impracticability of a 35-ft. chimney as the minimum height for a bungalow. Inadequate safety factors for firing-up periods it was felt, are given in the code, being less than those adopted by the Chicago Master Steam Fitters' Association. As now written, he added, the society's code can only apply to cast-iron boilers. A 3-hour attention period was recommended, instead of a 1-hour period on heating boilers for bituminous coal and a 10-hour period when burning hard coal.

Chairman R. W. Menk reported on Section 7 (relating to warm-air furnace heating plants) and called attention to the fact that there was no mention in the code of the use of fans connected to furnaces.

Reporting for the Committee on Section 8 (relating to the design of smoke flues, breechings and chimneys) Charles F. Newport stated that this section was almost strictly in accordance with the underwriters' code, but that some reference should be made to limiting of breechings. He said that 90% of the flue troubles are due to leakage and if a rigid smoke test were enforced, the trouble in good part would be eliminated. Mr. Linn suggested that a chimney specification of condensed code matter be compiled for the use of architects in places where no ordinances are in effect. Mr. Newport recommended 30 ft., instead of 35 ft., as a minimum chimney height. Discussion on breechings followed in which Mr. Linn told of how a change in the upward slope of from 18 in. to 20 in. corrected what had been an unsatisfactory boiler installation. Mr. Hart suggested that all breechings should be sloped upwards as much as possible and it was voted to add this recommendation to the committee's report.

THE NOVEMBER MEETING

When the chapter met November 10, the discussion continued from the point where it had left off at the previous meeting. Chairman M. S. Good of the Committee on Section 9 (dealing with steam pipe sizes) made the point that certain of the tables provided only for upfeed risers and that no mention was made of downfeed risers. Another important table, he stated, was based on 1 oz. drop in 100 ft. and was therefore not applicable to both vapor and vacuum heating systems. The chapter's recommendation on this section was that it be completely revised.

In his report on Section 10, dealing with pipe sizes for water heating systems, Chairman C. D. Allen made the point that it was essentially text matter and did not meet the requirements of code material. It was voted to recommend that this section be rewritten. President Linn expressed the belief that the data compiled by Professor F. E. Giesecke could be used to advantage in this section.

Section 11, dealing with air ducts as used in fan-blast work and with ventilating fans, was taken up by Chairman William J. Mauer. Mr. Mauer felt that the code devoted 40 pages to this section whereas, he thought, ten pages should be sufficient. He felt that the code was in error in the matter of dampers and expressed the belief that additional matter should be included on ventilation. Dr. E. Vernon Hill repeated his recommendation made at the society's summer meeting that all of the code definitions be kept together.

Taking up Section 12, devoted to air washers and filters, a number of minor changes were suggested, one being in connection with the resistance limit of air washers or air filters used for ventilating purposes which is given in the code as not to exceed ⅜-in. water gauge at normal rating. This resistance was questioned on the ground that it left considerable leeway. This part of the report was presented by J. H. O'Brien. The second part of the report dealt with air cleansing. One of the recommendations was that a minimum efficiency rating of 85% be specified for air cleaning devices and that the Research Laboratory in testing these devices publish its report as showing a greater or less efficiency for any given device, so as not to discriminate among the manufacturers.

CHAPTER OPPOSED TO COMMERCIAL TESTING BY RESEARCH LABORATORY

In this connection the point was brought out that the sentiment of the chapter is against commercial testing by the Research Laboratory, but that the laboratory could provide methods of testing and at the same time specify the efficiency required.

A report on Section 13 (pumps for heating and ventilating equipment) was presented by Chairman James J. Hayes who urged, among other things, the elimination of the data on screw pumps since they are no longer used in heating and ventilating work. The report also raised the point on the limitation of shaft speeds and suggested the specifying of the difference between centrifugal and rotary pumps.

In presenting Sections 1 and 14, Chairman John D. Small stated that many of the definitions used were those appearing in the Wisconsin State Industrial Code and should be eliminated since they made use of terms that were distinctly a part of the Wisconsin code.

The concluding report was presented by Chairman Otis and was devoted to Section 2, the much-discussed section on the heating and ventilating requirements of public buildings. He expressed the opinion that the public should be educated into good heating and ventilating practice, rather than legislated into it. He felt that Part 3, suggesting types of equipment required to meet the provisions of the code, should be omitted on the ground that

there are many possible combinations of quantities, designs and types of apparatus by which various percentages can be secured on the Synthetic Air Chart. The committee expressed its endorsement of the use of the Synthetic Air Chart in determining heating and ventilating requirements.

In the business session preceding the technical discussion, the chapter voted to defer its membership drive until the matter of society dues had been definitely settled. An invitation was received from the National Warm-Air Heating and Ventilating Association, for the chapter to attend the dedication of the association's Heating Research Residence at Urbana, Ill., December 8.

F. H. Gailherd and E. H. Cutter, of the Hoffman Specialty Co., were elected to membership in the chapter.

Fuel-Oil Has Its Inning With The New York Chapter

An announcement that various phases of the domestic fuel-oil situation would be discussed at the November meeting of the New York Chapter, at the Building Trades Club, November 17, served to bring out a record attendance of 140 members and guests, showing how keen the interest is in this subject. After opening the meeting, President W. J. Olvany turned over the gavel to Secretary Edward B. Johnson, who introduced the speakers.

Before the regular speakers was presented, Commissioner William E. Walsh, of the New York City Bureau of Standards and Appeals was introduced, his bureau being the one that passes upon oil-burning devices in use in New York City. Mr. Walsh discussed the steps which led to the complication of New York's fuel-oil rules and explained the reasons for their amendment this year. He thought that oil burning was on its way to become permanently established but that the safety in its use depended almost wholly on the mechanical installation.

Robert Adamson, president of the Petroleum Heat & Power Company, spoke on "Oil Burning in New York City," his remarks being devoted to installations in high-pressure boilers. He said that so far fuel-oil burning installations in New York City had displaced 500,000 tons of coal.

Oil, he said, will increase a boiler's rating 25% and is especially useful in meeting peak loads. As a relief for traffic congestion he cited the fact that an oil truck, with a capacity of 37 barrels, can carry twice as much in fuel value as a one-horse coal truck. The wide interest in the subject was evidenced by the fact that no less than 6000 patents had been applied for on burners for high-pressure boilers up to 1923.

Each plant, he said, was study in itself. The future of oil burning will be determined by the economic factor. As an indication of the way things are going, however, he instanced the fact that the City of New York, had arranged to install oil burning apparatus in the new court house building, and in the Municipal Buildings in both Manhattan and Brooklyn.

Under the title of "Oil in Place of Coal for Heating the Home," M. O. Horning, combustion engineer for the Standard Oil Company of New Jersey, launched into an extended discussion of the subject, taking the position that domestic oil heating was already an assured success. He made a sharp distinction, however, as to the kind of oil which could be burned successfully. He described distillate (26°–30° Baumé) and furnace-oil (39°–42° Baumé) as fuel-oils, the distillate running 7⅜₁₀ lbs. to the gallon and the furnace-oil 6 lbs. to the gallon.

He was frank to state that the cost of installation of a reliable domestic oil burner is high. Of the 2000 house-heating oil burners invented, he said, and the 600 submitted to the National Board of Fire Underwriters for approval, less than a dozen had been approved.

He advocated the delivery of oil in tank trucks rather than in barrels, such trucks holding from 1300 to 1500 gal. of oil. Some are divided into compartments.

The price of furnace oil in the Newark (N. J.) district, he said, is 9½ cents in 500-gal. lots and the price of distillate, 6½ cents in 1200-gal. lots. The speaker figured that 130 gal. of oil is equivalent to one ton of coal. On this basis, furnace-oil would compare with coal at $12.50 per ton and distillate with coal at $8.50 per ton. Tank capacities, he added, are usually 750-gal. with furnace-oil, and 1600-gal. with distillate. Mr. Horning stated that his company was encouraging the use of distillate.

Of the two types of burners used for this class of work, vaporizing and atomizing, Mr. Horning advocated the use of the atomizing type. One remedy for carbon deposits on the burner, he said, was the use of steam mixed with the atomized oil. In the vaporizing process it is necessary to gasify the oil before ignition. With natural draft there is no control of the air supply. An excess of air may reduce the efficiency to a great extent. Finally, the vaporizing process will burn furnace-oil only.

Mr. Horning considered atomizing the oil more practical. Steam, he said, is seldom used in house heating for atomizing the oil, as it is too noisy. Compressed air, as used in the large buildings, is also more or less noisy. He likened the atomization obtained through pressure to the action of a garden hose when the nozzle is throttled.

Other atomizing methods described by Mr. Horning were the churning of the oil and water and the centrifugal method.

The speaker emphasized the point that the furnace has to be changed to burn oil. The grate must be removed as well as the ash-pit door. In some installations the burner is arranged to throw the flames downward. Burners, he stated, which only allow oil to flow by gravity cannot use anything but the lighter oils. None of the burners, he said, is entirely silent. There is always a slight hum which has one advantage in indicating that the apparatus is working.

To start the oil burner, he advocated the use of an electric spark, generated by a relay and transformer. Such a spark usually lasts for one-half minute. He preferred this to gas pilot lights as the latter may blow out.

Domestic oil burners, said Mr. Horning, are not adapted to warm-air furnaces. Some burners are specially adapted to round boilers while others may readily be used in either steam or water boilers. The ordinary type of house-heating oil burners is not adapted to school and similar buildings as they are controlled by a thermostat located at a single point.

Mr. Horning placed the cost of an adequate equipment for burning distillate at $850.00, with all attachments, while a vaporizing outfit may be had for $60.00.

Among the points brought out in the discussion was that the secret of success in oil burning in homes lies in the original installation. One of the frequent causes of trouble is tampering with the devices by the owners.

Philadelphia Chapter Discusses the Designing and Heating of Homes

With architects, builders and others as their guests, the members of the Philadelphia Chapter devoted their November meeting, held at the Engineers' Club, November 13, to a symposium on the designing and heating of homes. The keynote in the discussions was the campaign of the Anthracite Economy Service to further the use of small sizes of buckwheat coal in house heaters.

C. Willing Hare, of the Anthracite Economy Service, outlined the hard coal industry's campaign of information and conservation. He was followed by D. Knickerbacker Boyd, consulting architect, whose subject was "How to Save the Occupant Trouble and Money by Planning the Home for Convenience and Economy in Heating."

Albert Kelsey, architect, talked on "The Chimney as an Object of Interest and Beauty," his address being illustrated with lantern slides showing photographs and sketches of notable examples of chimneys as essential architectural features. He also discussed errors frequently made in designing chimneys.

An address which proved particularly interesting was delivered by C. A. Connell, combustion engineer of the Anthracite Economy Service, who spoke on "Buckwheat Coal and Appliances for Its Economical Utilization in Existing and New Buildings."

Following these talks Director E. W. Parker of the Anthracite Bureau of Information presented motion pictures of the formation and mining of anthracite coal.

Annual Meeting in Boston

Boston is to be the host of the American Society of Heating and Ventilating Engineers at its annual meeting in January. The Massachusetts Chapter of the society, led by President William T. Jones, is busy making arrangements to receive the visiting engineers and President Jones has appointed a special committee, under the chairmanship of Alfred Kellogg, to work out the details of the entertainment and other features which will be interspersed with the technical sessions.

To comply with the constitution, a business session of the society will be held in New York, Tuesday, January 27, so that the opening session in Boston is scheduled for Wednesday morning, January 28. The meeting will then continue through the 29th and 30th, in Boston.

Headquarters will be at the Copley-Plaza Hotel, in the fashionable Back Bay district, facing Copley Square.

Kansas City Chapter Swells the A. S. H. & V. E. Research Fund

A statement in last month's issue of the action of the Kansas City Chapter in turning over to the society's Research Laboratory the surplus left after the expenses of the last summer meeting were paid, gains added significance from the fact that this surplus amounted to nearly $1,500.00. When the disposal of this balance came up for action, it was voted enthusiastically to turn it over to the Research Laboratory.

Time Required for Estimating Heating Work

Some interesting figures were given by William Bergner, of Granite City, Ill., at a recent district convention of the Associated Building Contractors of Illinois, on the compilation of labor costs for installing vapor heating systems.

"Before proceeding to state the actual time required for a given job," said Mr. Bergner, "it is necessary to explain how we can determine what is the correct amount of time to estimate. Obviously of course, we cannot, accurately, state the exact time that will be required, but I will present what conditions and experiences have taught us to consider in determining as nearly as possible, the time that will be required.

"In estimating work, the time is based on a number of conditions; the period of year in which the work will be installed—the efficiency and capacity of the organization employed—the condition of the market, relative to the amount of construction work under headway—and the amount of heating business contracted for.

"There are times when it is necessary to figure 14 hours per radiator for a particular kind of installation, and other times, when but eight hours estimate is sufficient for the same installation. With a regularly employed force of steam fitters and with sufficient business to keep them steadily employed, the contractor can figure nearly correct so far as labor time is concerned. If your working force fluctuates during the various seasons of the year, and half the year you employ ten or twelve teams, and the balance of the year but three fitters, it is essential that that be taken into consideration.

"These conditions exist throughout the country. In one territory you will find it requires 25% to 50% more time to perform a given amount of work than in another territory. It entirely depends on the various labor agreements entered into, the working rules in effect, also the efficiency of labor in the various territories.

"It is poor policy and should be guarded against, to estimate labor on the basis of time a rapid man in your organization can perform it. If you secure contracts that will occupy the time of your best laborer and require the employment of additional labor, you will find that the time estimated will not be sufficient. The additional cost of labor may more than just wipe out your entire margin of profit expected.

"It is always a sane and safe rule to estimate labor on what experience shows to you to be an average labor requirement. This really is insurance against loss on jobs where more time is required than was estimated.

WHY SHOULD CONTRACTOR GAMBLE?

"Why should the contractor be the sole gambler on a job? It is but proper that the owner should be required to shoulder, to assume part of the risk. When a contractor estimates labor on a basis of average time required for a given performance, each of the principals assumes his share of the risk and responsibility.

ESTIMATING A JOB

"As to the time required on the particular job considered in connection with this program, we find a total of 26 radiators plus 3 radiators on the third floor to be roughed in. We have 3 ceiling radiators in the basement, 11 leg and 1 small wall radiator on the first floor, 9 leg and 1 wall radiator on the second floor, and 1 wall radiator in the garage set a distance of 18 ft. from the boiler room.

"With my present organization, considering the season of the year and the volume of business on hand my estimate of labor for the installation of these radiators aggregates a total of 304 hours or 38 days for a steam fitter and helper, plus one day's time for digging trench to garage. Following is my tabulation of time that will be required based on cutting all pipe on the job.

20 leg radiators	10 hrs. each	200 hrs.
3 wall radiators	12 hrs. each	36 hrs.
3 ceiling radiators	13 hrs. each	39 hrs.
3 radiators (Roughed)	8 hrs. each	24 hrs.
Additional piping in trench to garage		5 hrs.

"One day time for labor, digging trench, refilling and installing split tile.

"For buildings of different construction, the time as estimated, probably would not be sufficient. For instance, reinforced concrete job with large size wall or ceiling radiators. Such a job would require added consideration for the assembling and installing of hangers, drilling walls for expansion bolts, working on scaffolding, setting sleeves and insets, or having more or larger size pipe to handle per radiator.

"The size of boiler and the boiler room equipment must all be estimated separately.

UNDERESTIMATING COST OF LABOR

"The study of labor cost on heating installations, has not been considered to the extent that it should have been. If it had, we would not have the million and one complaints from contractors, whose grief was that not sufficient time of labor had been figured on. This one point should be deeply impressed on your mind.

WHO IS RESPONSIBLE FOR HIGH COST OF LABOR?

"Who really is responsible for the high cost of labor? Is it the journeyman? From my point of experience, I am satisfied that 50% of the blame falls to the heating contractor himself. You inquire how I arrive at this conclusion? I'll tell you.

"Labor is frequently inefficient because too many of their employers are inefficient. Employers fail to supply the proper class of supervision on jobs. Employers provide poor grade of tools; wrong materials or insufficient material, and generally, poor co-operation.

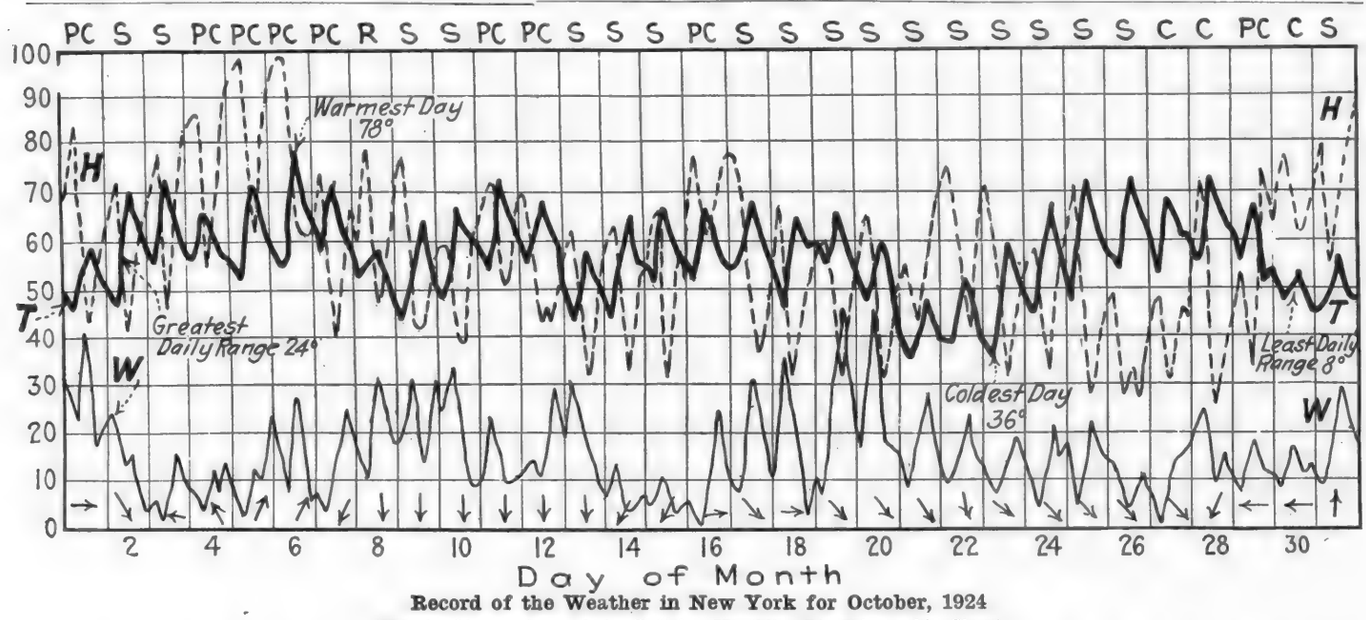
"Contractors can remedy and avoid many of the labor difficulties if they will endeavor to right conditions on their side.

Proposed Heating Plant for Municipal Court Group, Detroit

A project estimated to cost $350,000, in Detroit, Mich., involves the construction of a heating plant for heating the seven buildings of the Municipal Courts Group, in Clinton Park. The new plant is intended to supplant the present system which has been found inadequate. The monumental stack of the plant is to be 125 ft. high. The heating plant is being designed to burn oil. Carey & Esselstyn, architects and engineers, are the designers of the proposed heating plant.

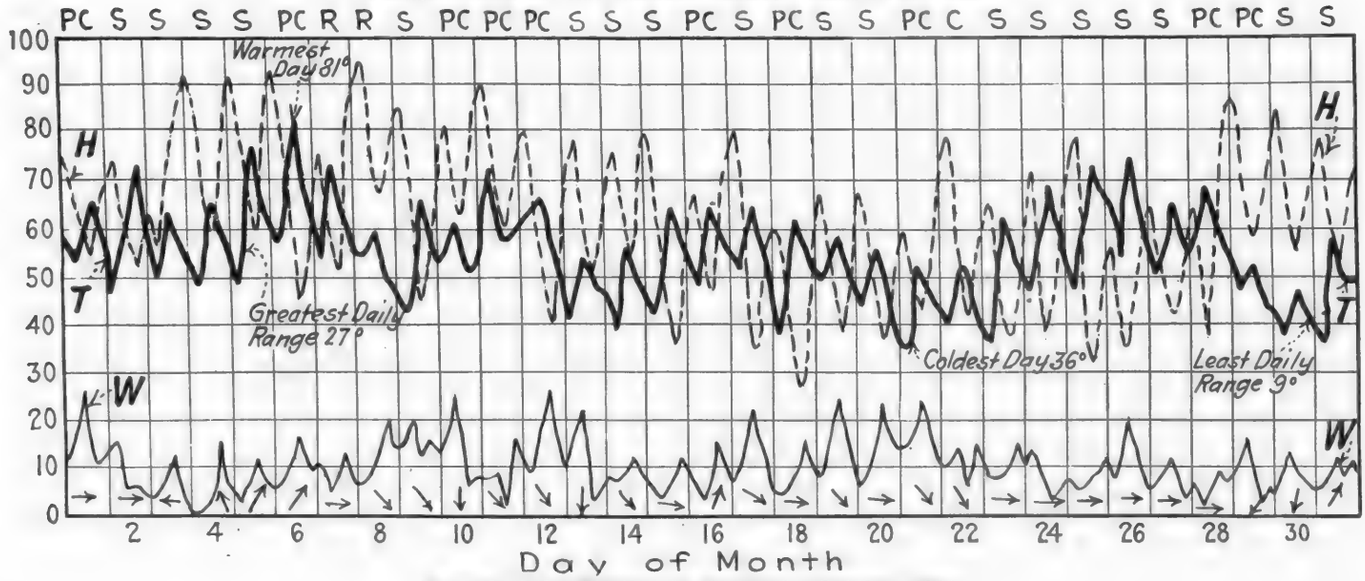
The Weather For October, 1924

	New York	Boston	Pittsburgh	Chicago	St. Louis
Highest temperature, deg. F	78	81	80	81	85
Date of highest temperature	6	6	3	19	18
Lowest temperature, deg. F	36	36	31	40	37
Date of lowest temperature	23	21	23	23	22
Greatest daily range, deg. F	24	27	35	27	27
Date of greatest daily range	2	5	11	1	1
Least daily range, deg. F	8	9	8	5	12
Date of least daily range	30	30	21	21	5
Mean temperature for month, deg. F	56.8	54.6	56.4	59.8	64.6
Normal mean temp. for month, deg. F	56.3	53.6	55.6	55.1	58.4
Total precipitation, in	0.30	0.06	0.12	0.84	0.30
Total snowfall, in	0	0	0	0	0
Normal precipitation, this month, in	3.71	3.86	2.36	2.55	2.41
Total wind movement, this month, in	10645	6762	5177	8548	8289
Average velocity, miles per hour	14.3	9.1	7.0	11.5	11.1
Prevailing direction of wind	N	W	N. W.	S	S
Number of clear days	18	17	14	23	22
Number of partly cloudy days	9	11	13	4	6
Number of cloudy days	4	3	4	4	3
Number of days with precipitation	2	2	3	4	4
Number of days with snow	0	0	0	0	0
Snow on ground at end of month	None	None	None	None	None

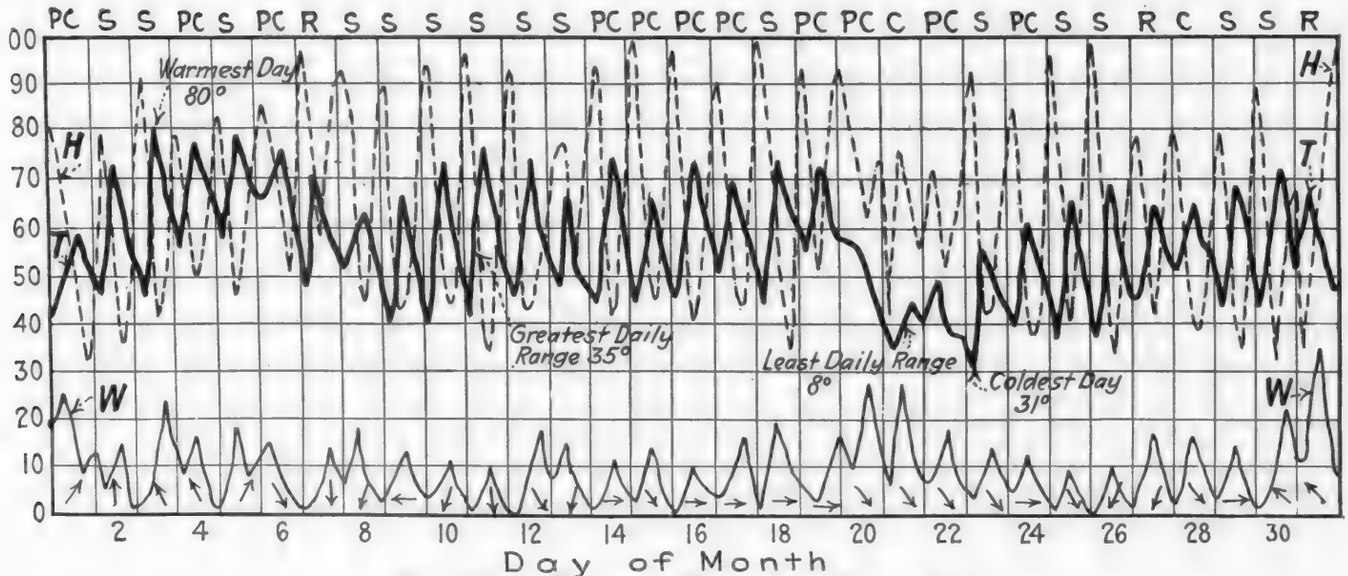


Record of the Weather in New York for October, 1924

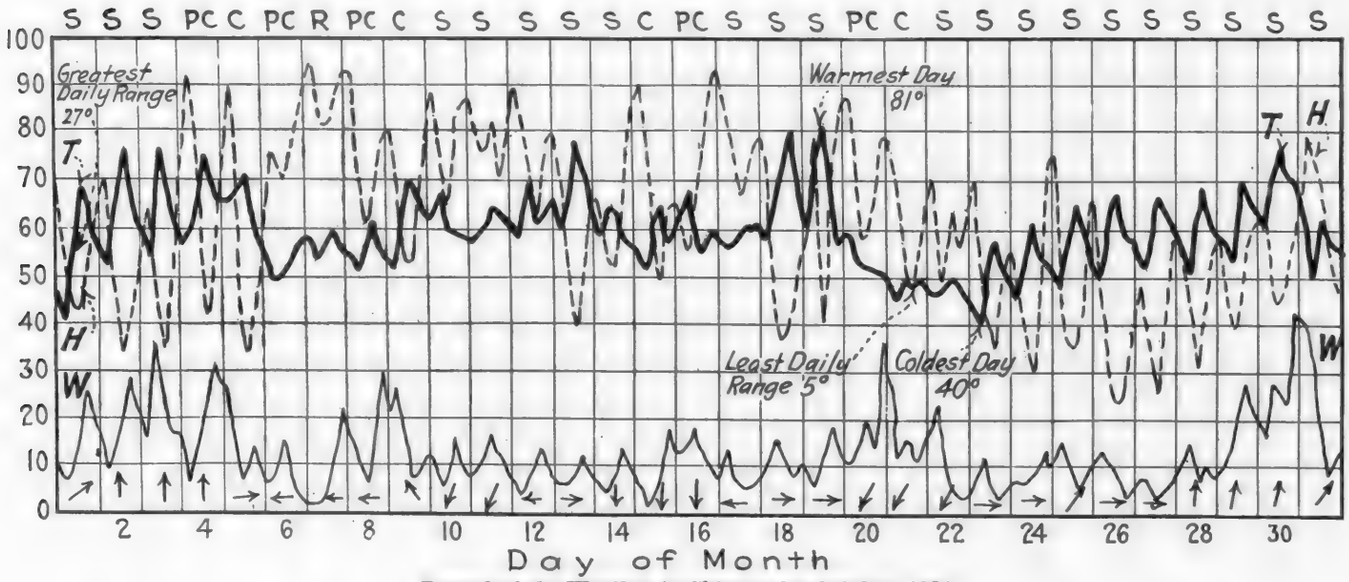
(Hourly Observations of the Relative Humidity Plotted on this Chart)



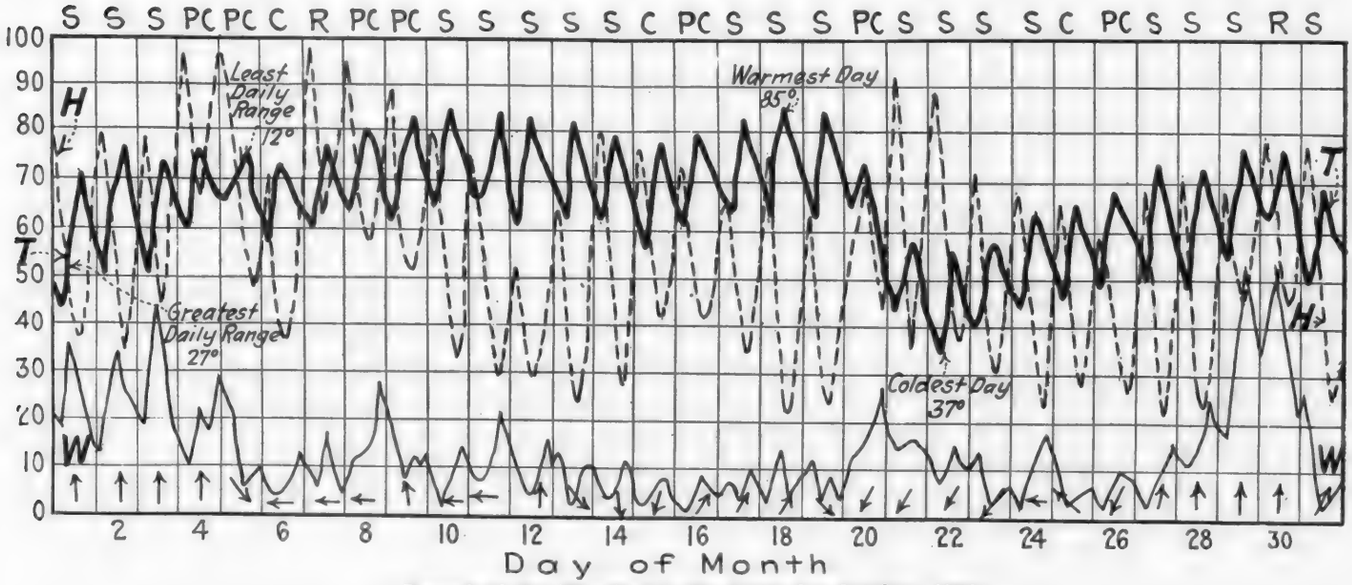
Record of the Weather in Boston for October, 1924


PC S S PC S PC R S S S S S S PC PC PC PC S PC PC C PC S PC S S R C S S R
Warmest Day 80°
Greatest Daily Range 35°
Least Daily Range 8°
Coldest Day 31°
H
T
W
Day of Month

Record of the Weather in Pittsburgh for October, 1924


S S S PC C PC R PC C S S S S S C PC S S S PC C S S S S S S S S S
Greatest Daily Range 27°
Warmest Day 81°
Least Daily Range 5°
Coldest Day 40°
H
T
W
Day of Month

Record of the Weather in Chicago for October, 1924


S S S PC PC C R PC PC S S S S S C PC S S S PC S S S S C PC S S S R S
Least Daily Range 12°
Warmest Day 85°
Greatest Daily Range 27°
Coldest Day 37°
H
T
W
Day of Month

Record of the Weather in St. Louis for October, 1924

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE, by the United States Weather Bureau.
Heavy lines indicate temperature in degrees F. Light Lines indicate wind in miles per hour.
Broken lines indicate humidity in percentage from readings at 8 A. M., 12 M., and 8 P. M. Arrows fly with prevailing directions of wind.
S—Clear, PC—partly cloudy, C—Cloudy, R—rain, Sn—snow.

Legal Decisions

Insufficiently Performed Heating Contracts

An instructive court decision covering claims for breach of a heating contractor's agreement connected with the installation of equipment is that handed down by the Arkansas Supreme Court in the case of Campbell vs. Kennerly, 145 Southwestern Reporter, 528.

Plaintiff sued for a balance claimed to be due for installing a heating plant for defendants. Defendants denied liability and counterclaimed for return of what they had paid on the price, asserting that plaintiff had failed to substantially comply with his contract to construct the plant of proper material and in a good workmanlike manner so as to provide satisfactory heat.

According to the terms of the contract, plaintiff agreed to install the plant, "the said heating apparatus to be placed in said building in such manner and located at such a point as shall be deemed best by said heating company for its most successful operation, it being guaranteed that said heating apparatus shall be constructed thoroughly in all respects of good material, and made smoke and gas tight, and that, subject to the requirements hereinafter specified, such heater shall furnish a pure, moist air and have a capacity to provide a temperature of 70° F. for the building in the coldest and windiest of weather."

Affirming judgment in favor of defendant owner, the Arkansas Supreme Court said:

"The law is settled that a contractor of this sort can not recover unless there has been a substantial compliance on his part with the terms of the contract, or, in other words, unless he has furnished the material and performed the work substantially as provided in the contract. . . .

"It is insisted by learned counsel for appellant [plaintiff contractor] that there is a decided preponderance of the testimony of witnesses introduced by appellant who show an accurate knowledge of this kind of work, and that the testimony of many of the witnesses upon the part of the appellees [the owners] should be disregarded on account of obvious lack of such knowledge. They insist that there should be a considerable degree of expert knowledge on that subject before the testimony of witnesses can be accorded any probative force. We have duly considered these matters, and, upon the whole, we are convinced . . . that the state of the testimony is such that it is impossible for us to say that there is any preponderance in appellant's favor. . . .

"We should add that, inasmuch as appellees rejected the work and refused to pay for same, it is still the property of appellant, and may be removed from the premises, as far as that can be done without injury to the building."

Owner Waived Right to Architect's Certificate

A trial court improperly ruled that a heating contractor's failure to produce a certificate of a supervising architect that a heating system had been installed in accordance with contract terms necessarily prevented him from recovering the agreed compensation, held the Pennsylvania Superior Court in the recent case of Jost & Jost vs. Kurtz & Kurtz, 82 Pa. Super. 205.

Plaintiffs sued to recover a balance as being due on a written contract to install a vapor heating system in defendant's building. The defendants denied that the contract had been performed.

The written contract provided that when the heating plant was completed plaintiffs should test it in the presence of the architect and prove it tight under a steam pressure of 15 lbs. It provided further that all work should be executed "to the entire satisfaction and written acceptance of the architect."

At the trial plaintiffs offered evidence tending to show that when the work was completed, and they were ready to make a test of the plant, the architect failed to appear and one of the defendants owners suggested that the test be made in the absence of the architect; and that the result of the test was perfectly satisfactory to the defendants. But, nevertheless, the trial court ruled that there could be no recovery because plaintiffs failed to produce a certificate of the architect and acceptance thereunder. Reversing the trial court's ruling, the Superior Court said:

"We do not agree that it was necessary for plaintiffs to produce a certificate from the architect showing that the heating plant had been completed to the satisfaction of the defendants before there can be a recovery on this branch of the case under the circumstances. This is not a case in which a certificate of the architect is made a condition precedent to the making of the final or any other payment by the owner. Under the contract, the last payment was due upon completion and test of the heating system. There was evidence that the system was completed and that the test was satisfactory. If the heating system was completed by plaintiffs, defendants could waive their right to insist upon the certificate. If they expressed satisfaction with the plant and chose to accept it on their own responsibility, it was for the jury to say whether or not they had waived their right to insist upon the certificate. This is so firmly established that it must be accepted as the settled law in this State."

Rates For Central Station Heating Service

In fixing new increased rate schedules for service on the application of the Midland Public Service Corporation, the California Railroad Commission, February 29, 1924, said: "Present rates for heating service are as low as 1% per kilowatt hour for consumption in excess of 125 K.W.H. per month which is less that the cost of service. This condition must be corrected if this class of load is to be served in the future without penalty to other consumers. The new heating and cooking rates will partially correct this discrimination and provide a minimum charge, based upon the size of installation. While this will result in a considerable increase to this class of consumers, and particularly to those individuals using large quantities of energy, the new schedules are still as low as any others in the State of California."

Right of Sub-contractor Installing Heating Plant to Action on General Contractor's Bond

In an action in the Missouri courts against the directors of a school district it was alleged that the defendants entered into a contract with a general contractor, whereby, among other things, the latter agreed to install a heating plant and plumbing system in a school building in course of erection for the district. Thereafter, the plaintiffs, by subcontract, agreed with the general contractor to furnish and install the heating and plumbing plant; and this they did. They alleged that they relied upon the assumption that the general contractor had given bond as the Missouri statute required, and asked for damages as for neglect of a ministerial duty by directors of the school district.

The principal contract contained no express provision that the contractor should pay for all materials and labor, but that he should provide same. The evidence showed that the heating plant installed was not of the kind prescribed by the contract. Evidence was offered to show that this was due to conditions which rendered it impossible to comply with the contract in this respect. The contractor's bond was conditioned that the contractor should perform all his obligations and keep the principal indemnified against all liens and claims, etc. The bond was in a form appropriate for use to secure the performance of a building contract between a contractor and a private individual, although it was headed "Statutory Bond."

The Missouri statute, R. S. 1919, sections 1040, 1041, provides that school boards in contracting for public work shall require the contractor, with sufficient sureties, to execute a bond in sufficient amount, which, among other

conditions, "shall be conditioned for the payment of material used in such work and for all labor performed in such work, whether by subcontractor or otherwise." Subcontractors are expressly given a right of action on the bond.

The plaintiffs contended that the bond given was so far from complying with this statute that they could not maintain an action on it, and therefore it was equivalent to the taking of no bond at all, so far as the plaintiffs' rights were concerned, and as a consequence, they were entitled to sue the district directors under the general rule that an officer's neglect of a ministerial duty imposed for the benefit of individuals is actionable. There is authority for the proposition that the omission to incorporate in a writing a provision which a statute specifically requires an officer to incorporate is the failure to perform a ministerial duty. The defendants contended that the bond taken would support an action by the subcontractors, in which case this action would not lie.

The Missouri Supreme Court holds, Fogarty v. Davis, 264 S. W. 879, that the rule in that State is that, in construing a statutory bond, the provisions of the statutes must be read into it and construed as a part of it. It was obvious that the parties were acting under the statute, and that there was no other legal obligation resting upon them which called for a bond of any other kind. The above rule was therefore held to be applicable, and the bond given, when construed in its light, was held to give the plaintiff subcontractors an action upon it. It resulted that there was no actionable neglect on the part of the defendant district directors which rendered them liable to the plaintiffs.

In circumstances like those in this case, a contract to provide or furnish labor and materials is held to be a contract to provide them at the "proper cost, charge and expense" of the contractor. No intent to defraud laborers and materialmen ought to be attributed to the parties. In view of the Missouri statute and the attempt to comply with it, that fact was considered in the construction of the contract in this case; and, so construed, the subcontractors were held to have a right of action on the bond for that reason also. Judgment for the defendants was therefore affirmed.

Correspondence

The Change from Coal to Oil in the Home-Heating Plant

EDITOR HEATING AND VENTILATING MAGAZINE:

The writer spent twenty-five years in the coal-burning navy. When first he went to sea in the battleship Indiana, there was just enough spar-and-sail left in our navy to bear witness to the glorious days when the man-o'-war was a ship. But those of us who experienced a touch of sadness in stowing away the topsail halliard to take up the coal shovel, have found our consolation in the oil pipe. Now that our unpolluted decks have been restored in the happy era of oil, the horrors of the coal age are better forgotten than described. In our navy the ship is a home, as well as a machine. Having experienced the blessing of an oil-burning home afloat, the writer hopes to live to see the day when he shall partake of a like benediction on the home ashore.

With all his hardships the seaman usually has one luxury to enjoy, and that is the luxury of cleanliness. Of all the luxuries that can be brought into the home, these three, comfort, convenience, and cleanliness, are the most satisfying and the most enduring. With the coal-burning heating plant, a comfortable temperature in the home may be obtained. But this appliance is no conspicuous advocate either of convenience or cleanliness.

It has been during these last four years and more that the writer has been retired from active service in the navy that the problems of the home have come in for a larger share of his attention and study than ever before. Furthermore, for three years he had two homes, one that he was living in and the other for rent or sale. It was disheartening to find in that home which had been occupied by others the accumulation of dust arising from the service of the coal-burning furnace. Even in this home where the writer has personally tended the furnace, the dust is ever-present and all-pervading, try in every way that one can to minimize this nuisance.

When it comes to the handling of coal and ashes and the wood to start the fire, the time and energy expended, and the wear and tear on person and clothing, these are items to be taken into consideration in contemplating the change from coal to oil in the home-heating plant. In the writer's view of the situation, the time is coming, and not far away, when all solid combustibles will be converted into liquid or gaseous form in large central plants for distribution to home and factory. Already the solid fuel is out of place in advanced communities.

As to the relative cost, the oil may cost a trifle more than the coal. On the other hand, the saving in thought, care, attention, and time, more than makes up for the difference in the price of the fuel.

Boonton, N. J. GILBERT P. CHASE.

Dust in Air Ducts

EDITOR HEATING AND VENTILATING MAGAZINE:

It is a remarkable fact that only the engineers for the Chicago and Detroit Boards of Education seem to have given any specific attention to the necessity of providing means for cleaning air ducts. As is now well known, to insure the delivery of clean air through an air duct, a prerequisite is to build every foot of the duct or conduit so that it is accessible for cleaning and then to spend the amount of money necessary to keep the conduits clean.

Those connected with the industry are often criticised for calling attention to the amount of atmospheric filth that can collect in the ducts of a ventilating system, but we are confident the time will come when our knowledge of sanitation in ventilation will progress to the point where people will rather drink water from the gutter than to breathe the air supplied through an uncleanable duct or conduit system.

The principles of successful housekeeping are really the basis of every worth-while operation performed for the service of man. I respectfully submit that the installation of any passage for air supply or air removal in any building that is inaccessible for cleaning is a violation of one of the first principles of successful housekeeping, that is, sanitary cleanliness.

N. C. H.

Flashing of Condensation in Return Pipes

EDITOR HEATING AND VENTILATING MAGAZINE:

I have heard a good deal of talk about the water of condensation in a two-pipe vapor vacuum system flashing back into steam when it enters the return in which there is a vacuum, after leaving the radiators in which there is a pressure, and I desire to know how such a thing can occur to the extent of affecting the vacuum pump. To give a concrete problem:

Assuming 2 lbs. gauge pressure in the radiator and 9.34 lbs. absolute pressure, or 10 in. vacuum in the returns. Then the water of condensation on leaving the radiator would have a total heat content of 187.10 B.T.U. per pound. On passing into the return under 10 in. of vacuum, it would need to have only a total heat content of 157.91 B.T.U. to remain water. Therefore, there will be 29.19 B.T.U. to spare, which would go towards supplying the latent heat necessary for some of the water to flash back into steam.

The amount of latent heat necessary to make 1 lb. of steam under this vacuum is 983.9 B.T.U. Therefore, is can be seen that it would be necessary to gather the spare heat units from 33.7 lbs. of water in order to have enough to allow 1 lb. of water to flash back into 1 lb. of steam and, as I see it, it would be a pretty hard propo-

sition to gather these spare heat units from so many pounds of water at one time to make 1 lb. of steam.

I should be very much pleased to have your ideas on the matter.

New York. G. D. C.

Rules For Finding Contents of Partly Filled Tanks

An interesting table has been compiled by J. C. Hornung, of Chicago, Ill., central station heating engineer and manufacturer of central heat appliances, for figuring the amount of oil in partly-filled round horizontal or vertical tanks.

RULES FOR FINDING GALLONS OF OIL IN PARTLY-FILLED ROUND HORIZONTAL AND VERTICAL TANKS

HORIZONTAL TANKS. MULTIPLY FACTOR OPPOSITE $\frac{\text{INCHES OF OIL}}{\text{DIA OF TANK}}$ BY FACTOR OPPOSITE DIA OF TANK (IN INCHES) BY LENGTH OF TANK (IN FT.)

VERTICAL TANKS. MULTIPLY FACTOR OPPOSITE 1 (WHICH IS .7854) BY FACTOR OPPOSITE DIA OF TANK (IN INCHES) AND BY HEIGHT OF OIL (IN FT.)

FACTORS MAY BE USED FOR ANY LIQUID IN ANY CYLINDRICAL CONTAINER UP TO 120 INCHES IN DIA. AND FOR ANY LENGTH

INCHES OF OIL ÷ DIA. OF TANK	FACTOR	INCHES OF OIL ÷ DIA. OF TANK	FACTOR	INCHES OF OIL ÷ DIA. OF TANK	FACTOR	INCHES OF OIL ÷ DIA. OF TANK	FACTOR	INCHES OF OIL ÷ DIA OF TANK	FACTOR	DIA. OF TANK IN INCHES	FACTOR	DIA. OF TANK IN INCHES	FACTOR	DIA. OF TANK IN INCHES	FACTOR	DIA. OF TANK IN INCHES	FACTOR	DIA. OF TANK IN INCHES	FACTOR
		.075	.0268	.29	.1891	.53	.4227	.77	.6489	1	.052	25	32.5	49	124.7	73	273.8	97	488.8
		.080	.0294	.30	.1982	.54	.4327	.78	.6572	2	.21	26	35.1	50	129.9	74	284.5	98	498.9
.001	.00004	.085	.0322	.31	.2074	.55	.4426	.79	.6655	3	.49	27	37.9	51	135.1	75	292.2	99	509.4
.002	.00012	.090	.0350	.32	.2167	.56	.4526	.80	.6738	4	.83	28	40.7	52	140.5	76	300.1	100	519.5
.003	.00022	.095	.0379	.33	.2260	.57	.4625	.81	.6815	5	1.30	29	43.7	53	145.9	77	308.0	101	529.9
.004	.00034	.10	.0409	.34	.2355	.58	.4724	.82	.6893	6	1.87	30	46.8	54	151.5	78	315.0	102	540.5
.005	.00047	.11	.0470	.35	.2450	.59	.4822	.83	.6969	7	2.55	31	49.9	55	157.2	79	324.2	103	551.1
.006	.00062	.12	.0534	.36	.2546	.60	.4921	.84	.7043	8	3.33	32	53.2	56	162.9	80	332.5	104	561.9
.007	.00095	.13	.0600	.37	.2642	.61	.5018	.85	.7115	9	4.21	33	56.7	57	168.8	81	340.8	105	572.8
.008	.00113	.14	.0668	.38	.2739	.62	.5115	.86	.7166	10	5.19	34	60.1	58	174.8	82	349.3	106	573.7
.009	.00123	.15	.0739	.39	.2836	.63	.5202	.87	.7254	11	6.03	35	63.6	59	181.8	83	357.9	107	594.8
.010	.00133	.16	.0811	.40	.2934	.64	.5306	.88	.7320	12	7.48	36	67.3	60	187.0	84	366.6	108	6050
.015	.0024	.17	.0886	.41	.3032	.65	.5404	.89	.7384	13	8.77	37	71.1	61	193.3	85	375.3	109	616.0
.020	.0038	.18	.0961	.42	.3130	.66	.5499	.90	.7445	14	10.2	38	75.0	62	199.7	86	384.2	110	6286
.025	.0052	.19	.1039	.43	.3229	.67	.5584	.91	.7504	15	11.7	39	79.0	63	206.0	87	393.2	111	640.1
.030	.0069	.20	.1118	.44	.3328	.68	.5687	.92	.7554	16	13.3	40	83.0	64	212.8	88	402.3	112	651.7
.035	.0086	.21	.1199	.45	.3428	.69	.5780	.93	.7612	17	15.0	41	87.3	65	219.5	89	411.5	113	663.3
.040	.0105	.22	.1281	.46	.3527	.70	.5872	.94	.7662	18	16.8	42	91.6	66	226.3	90	420.8	114	675.1
.045	.0126	.23	.1365	.47	.3627	.71	.5964	.95	.7707	19	18.8	43	96.1	67	233.2	91	430.2	115	687.0
.050	.0147	.24	.1446	.48	.3727	.72	.6054	.96	.7749	20	20.8	44	100.6	68	240.2	92	439.8	116	699.0
.055	.0169	.25	.1536	.49	.3827	.73	.6143	.97	.7785	21	22.9	45	105.2	69	247.3	93	449.3	117	711.0
.060	.0192	.26	.1623	.50	.3927	.74	.6231	.98	.7817	22	25.2	46	109.9	70	254.6	94	459.0	118	723.4
.065	.0217	.27	.1711	.51	.4027	.75	.6319	.99	.7841	23	27.5	47	114.8	71	261.9	95	468.9	119	735.6
.070	.0242	.28	.1800	.52	.4127	.76	.6405	1.00	.7854	24	29.9	48	119.7	72	269.3	96	478.8	120	748.0

Mr. Hornung gives two examples, showing how to use the table. In the first example a round horizontal tank is considered, 36 in. in diameter and 5 ft. long, containing 12 in. of oil. Divide 12 (inches of oil) by 36 (diameter of tank), which equals 0.33. Turning to the table, the factor after 0.33 in the fifth column is 0.2260. Multiply 0.2260 by 67.3 (the factor after 36 in. diameter of tank in thirteenth column). The product is 15.2 gal. per foot of tank, or 76 gal. in tank.

To figure a round vertical tank, 40 in. in diameter and 4 ft. high, containg 2 ft. of oil, multiply the factor after 1.00 (ninth column) which is 0.7854 by 83.0 (the factor after 40 in. diameter of tank in thirteenth column). The product is 65.2 gal. for 1 ft., or 130.4 gal. for 2 ft. of oil in the tank.

The table may be used in the same manner for pipe lines of any size up to 120 in. and for any length.

Further Data on School Building Programs

In the concluding installment of the data on present and prospective school building plans, published in the *American School Board Journal* for October, figures are given for a number of additional cities.

In Binghamton, N. Y., for instance, the board of education has adopted a building program to cover a period of five years. This includes the erection of two 40-room elementary buildings, one 20-room elementary building and one 20-room addition to an elementary building, and at least three junior high school buildings. Some of this construction is already under way, including one of the larger elementary buildings and a junior high school. A site has been secured for a second large elementary building which, with its equipment, will cost no less than $5,000,000. The city's present seating shortage is 1500.

Even if this program is carried out, it is figured that at the end of the five-year period the city would need one additional junior high school, one senior high school and two large elementary schools. All of the building funds are raised by bond issues. For 1924 the building expenditures will approximate $600,000.

In Kenosha, Wis., the report of a survey by a citizen's committee on the school housing situation was adopted. This means a five-year program, beginning with 1922 and extending to 1927, involving an expenditure of $3,000,000. The board now finds itself two years' behind, owing to difficulty in securing sites and delays in preparing plans. The contracts let to date in this program amount to $1,016,591, without equipment. It is probable that the program will cover a period of ten years as matters now stand.

In Lincoln, Neb., a program has been adopted covering from six to seven years. It contemplates one grade and one junior high school building. The funds for both will be raised by bond issues.

San Diego, Cal., has adopted a building program to take care of the increase at the present rate for three or four years. Recently the district was bonded for $1,250,000 and to this will be added $250,000 from direct taxation. Actual expenditure during the year 1924 will amount to $1,500,000.

St. Paul, Minn., has mapped out its building activities to bring its school accommodations up to date with the close of 1925. At the present time the city is completing the last units of a program begun during the war. The city will follow this with a program adopted in 1922, involving an expenditure of $5,000,000. Under this plan the city will build two junior-senior high schools, six junior high schools, twelve new grade schools and fourteen additions to existing school buildings.

In Uniontown, Pa., after a survey by the United States Board of Education, the local board accepted a building program providing for two new junior high schools, to cost $600,000.

In Youngstown, O., the building funds for the present and the following three years will amount to about $750,000 a year.

The Superior, Wis., board of education has adopted a limited program providing for additions to present buildings involving about $200,000 and covering two years.

Gas House-Heating Tests in Twelve Homes

An interesting test has been arranged by the Spokane Gas & Fuel Company, of Spokane, Wash., in which twelve homes will be heated this winter with manufactured gas as the heating medium and the results noted. Six houses have been selected with warm-air furnaces and six with water heating systems. According to Floyd Norgren, new business manager for the company, special types of boilers, of the Bryant type, and warm-air fur-

naces will be installed without expense to the property owners.

The houses in which the tests are to be made were secured by the gas company through invitations sent to 100 consumers explaining the purpose and plan of operation. The experiments will be in the direct charge of C. A. Gates, who is manager of the company's house-heating department.

The Convention of American Gas Association

An attendance of nearly 4,000 members and guests was registered at the recent convention of the American Gas Association in Atlantic City. One of the principal papers from the heating man's standpoint presented at the meeting was that of Charles A. Munroe, chairman of the board, Laclede Gas Light Company, St. Louis, Mo., whose subject was "House Heating—Do We Want It? Can We Get It?"

The primary phase that demands the attention of the gas producers deals with the possibility of obtaining the domestic business. Only through strenuous sales effort, said Mr. Munroe, will the companies convince the public of the value of gas heat. It is possible, however, through enterprise to educate them to make the change—a change not nearly so radical as the transition from the log fire to the coal-heated boiler.

The possible volume of the gas business for house heating equals five to fifteen times the present volume of a company's business, stated Mr. Munroe. This means that for residential heating there would be required over one and one-half trillion cubic feet, or a yearly revenue of $1,250,000,000.

The third aspect of the situation is: Do the gas companies want this business? Is gas heating of homes profitable to the gas company? Here is a statement recently published pertaining to the problem: "The experience in more than 2000 towns in the natural gas territory where gas-fired house heating has been tried on a large scale, shows the folly of attempting universal gas house heating on account of the load characteristics and the enormous investment in a plant which would be used only to a very limited extent in comparison to the size required to meet the extremes of demand."

The complexity of the problems involved in reaching a satisfactory answer as the desirability of the heating business demands that no solution of them be based on conjecture or hypothesis. Mr. Munroe proves that the effect on the gas business is so far-reaching that the conclusion must be drawn from facts and not theory.

Tests were conducted by the Laclede Gas Light Company, to determine the actual profit-making possibilities of universal gas house heating. The conclusions which Mr. Munroe reached after careful study of his data are indicative of the general trend toward more careful consideration of the gas heating question. He found, for instance, that the heating business requires 2.58 times larger production capacity in order to take on a heating load equivalent to the present annual sales. Also that, after charging house heating with increased plant charges, and increased distribution charges, the company would receive 7.6 cents more per 1000 cu. ft. for its gas sold for house heating than it received for its gas sold to the household using an average of 3500 cu. ft. per month.

While the scope of the experimental work was necessarily limited, Mr. Munroe feels qualified to recommend to gas manufacturers that they secure house-heating business and attach recording instruments on their meters in order to obtain a graphic chart of the heating load throughout the season. If 50% of the gas companies would do this there would be provided sufficient data to settle the question definitely and completely.

Means of caring for the slack load during the summer and certain hours during the day would simplify the business of house heating to no small expense. The investment required to provide for the peak load would fall not entirely on house-heating costs but on the other forms of gas-fired fuel-burners as well. A year of enterprising research, he concluded, will furnish data for a more comprehensive answer to the question than is possible to-day.

Another paper on "House Heating," by G. I. Vincent, of the Syracuse Lighting Company, gave additional details of the experiences of this company in heating houses with gas, with especial reference to an experiment carried out during the past winter in a house formerly heated by coal. Where, in cold weather, it had been impossible to heat the house comfortably with coal, the use of gas in the same heater overcame this difficulty.

Among the exhibits were many of interest to heating and ventilating men. Gasteam radiators were exhibited by James B. Clow and Sons, Chicago. The Robertshaw Thermostat Company, Youngwood, Pa., exhibited its line of thermostats, while the exhibit of the United Utilities and Engineering Corp., Lansdale, Pa., was its Heatomat gas boiler. Other exhibitors were the National Tube Company, and the American Schaeffer and Budenberg Corp., which showed its line of pressure and other types of gauges.

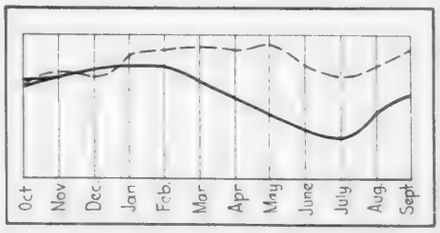
Ideal gas boilers and Wolff gas-fired steam radiators were shown by the A. H. Wolff Gas Radiator Company, New York. An exhibit of the Mueller products was made by the Mueller Company, Decatur, Ill. Bryant hot water heaters and gas boilers occupied the booth of the C. L. Bryant Boiler Company, Cleveland, O.

NEW OFFICERS

The new officers of the association are: President, Harry C. Abell, New York; vice-president, Charles L. Holman, St. Louis, Mo.; treasurer, H. M. Brundage, New York. Members of the executive board to serve two years: D. D. Barnum, Boston, Mass.; R. B. Brown, Milwaukee, Wis.; Howard Bruce, Baltimore, Md.; M. B. Daly, Cleveland, O.; Henry L. Doherty, New York; Charles A. Munroe, St. Louis, Mo., and D. J. Young, Tacoma, Wash.

Seasonal Employment in the Steamfitting Trade

Interesting figures on seasonal employment of steam fitters in New York City are contained in a report on the subject by Henry B. Gombers, secretary of the Heating and Piping Contractors' National Association, presented at the annual meeting of the American Trade Association Executives.



Seasonable Employment in Steamfitting Industry in New York City

From the statistics of the past four years a curve for the steamfitting trade was developed as shown by the solid line in the accompanying chart. The broken line shows the employment figures from October, 1923, to September, 1924.

The chart emphasizes the results of lack of employment during the dull summer season and how the peak of employment comes during the winter, also what an advantage it would be to secure a more even curve in the way of furnishing better service at less expense.

Standardized Roughing - In Dimensions of the Dunham Radiator Traps

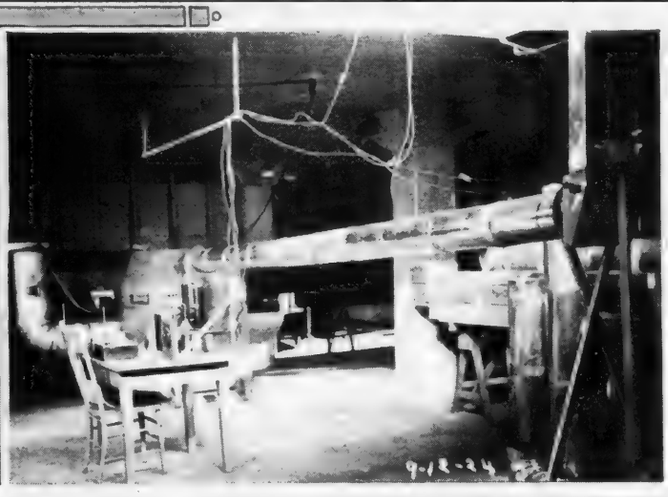
As is well known, the Dunham No. 1 and No. 2 radiator traps, manufactured by the C. A. Dunham Co., Chicago, Ill., have for some time been constructed to meet the 3¼-in. standard roughing-in dimensions of the Heating and Piping Contractors' National Associations. A statement in the company's advertisement in THE HEATING AND VENTILATING MAGAZINE for November, that these traps "meet the 1¾-in. standard roughing-in dimensions" is, of course, an error, and is especially regrettable since the Dunham company has pioneered in the matter of standardizing its traps in accordance with the recommendations of the heating contractors' national association, and has been highly commended for its prompt acquiescence in conforming to the new standard.

Engineering Pro

Equipment of the Mecha tories of the Universit and Demonstrating lating

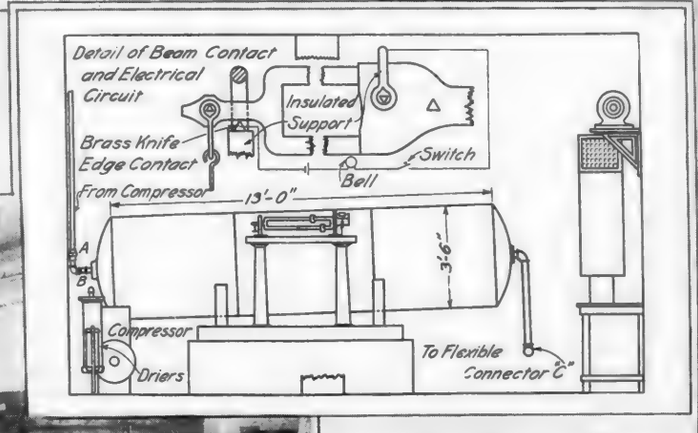
The Corbels Symbolic of Heat He
New American Radiator Com

1
Salamander



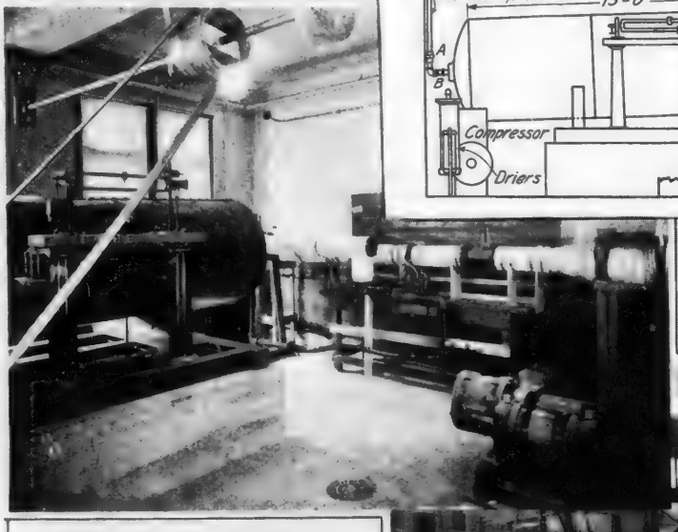
2
Toper

Auxiliary Electrically - Heated Furnace Plant Used in Studying Flow of Air Under Gravity Conditions.



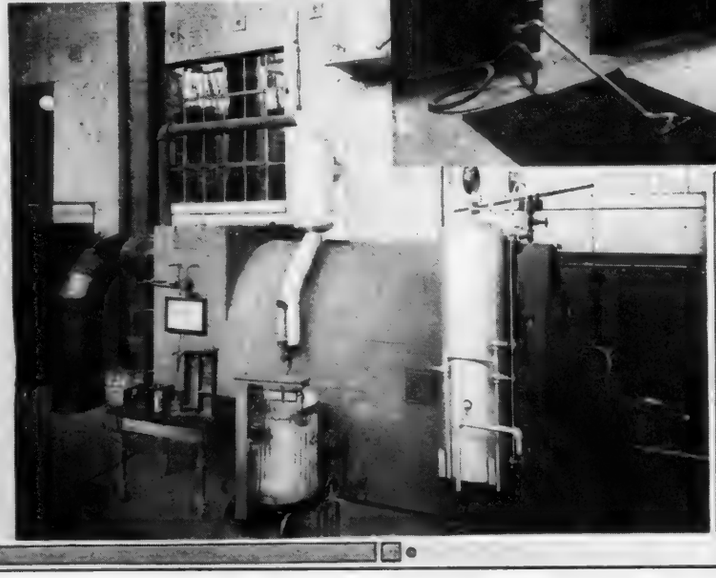
Sectional Elevation Air-Weighing Plant.

Mechanical Engineering Laborat
Where the Illinois Short Course
Was



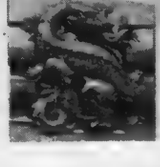
Air-Weighing Plant for Calibrating Orifices, Nozzles, Pitot Tubes and Anemometers Under Precision Conditions.

5
Labor



Corner of Mechanical Engineering Laboratories, University of Illinois, Showing Vacuum Cleaning Outfit, Air Washer, Direct Steam Radiator and Fan-Blast Heating Units Used to Demonstrate Principles of Their Operation.

7
Griffin



Down-Draft Smokeless Steam - Heating Boiler Equipped for Test. Boiler Supplied with Hot Condensation from Fan-Blast Heater Coil. (See overhead tank.)

Warm-Air Heating Research
Air Heating and Ventilating
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Heating and Venti-
Apparatus

Here Reproduced Are Those on the
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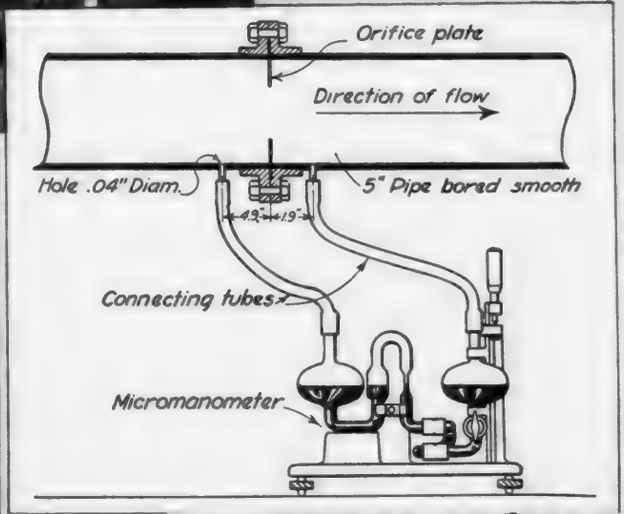
3
Hatred

4
Love

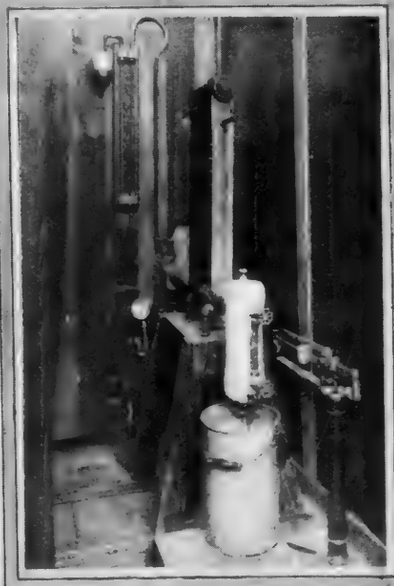
ries of the University of Illinois
e in Steam Heating and Plumbing
s Held.

Main Testing Plant Used in Warm-Air Furnace Research, University of Illinois Engineering Experiment Station.

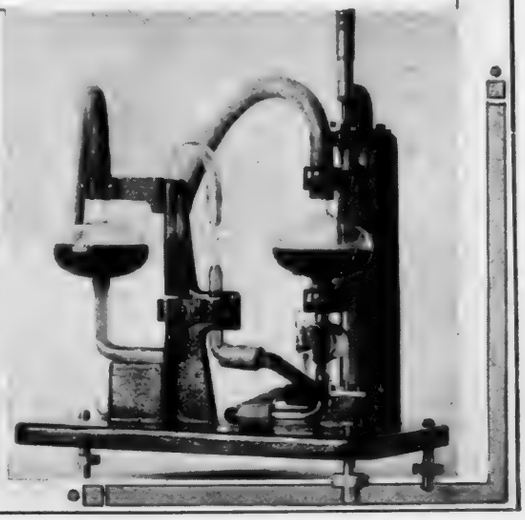
Another View of the Mechanical Engineering Laboratories, University of Illinois, Showing Air Washer and Other Apparatus Used in Tests and Demonstrations.



6
Fury



Wahlen Gauge as Connected to Section of Pipe for Measuring Air.



Residence of the National Warm-
Association in Urbana, Ill., Dedi-
ember 2, 1924.

8
Phoenix

One of Four Radiators Used to Demonstrate Factors Affecting Heat Transmission of Steam Radiators.

Wahlen Gauge Developed at University of Illinois for Indicating Small Pressure Differences or Heads in Air Measurement Work.

How "Certified Heating" Benefits Both the Public and the Contractors

What "Certified Heating" does for the public and for the contractor is outlined in an interesting way in the current issue of the *Official Bulletin* of the Heating and Piping Contractors' Association.

"First of all," states the writer, "the buyer of 'certified heating' enjoys a piece of mind that comes from the knowledge that his heating plant is installed properly and will serve him in the time of need. He derives the same satisfaction from this assurance that he does from the purchase of certified milk for his family or certified bread.

"The forward-looking heating contractors have sensed this state of affairs and, without waiting for government regulation, are co-operating with their fellow contractors in giving the public a heating service which is guaranteed to do the work for which it is designed and the correctness of which is certified not alone by the contractor making the installation, but by the entire local association of which he is a member.

WHAT IT DOES FOR THE CONTRACTOR

"While the benefits to the public are of prime importance to the home builder and of almost equal importance to the heating contractor in that suspicion is removed from the mind of the buyer and the way of the salesmen made easy, the benefits to the heating contractor are even more pronounced.

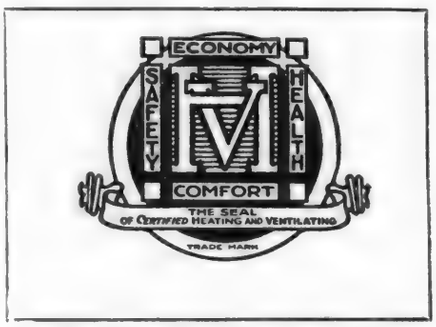
"In the building industry or, in fact, in any construction contracting business wherein every contract was for the performance of some piece of work differing from the work done before and for which it is difficult to establish any basis of uniform charge the seller

Seal Used on Fire Doors by Memphis Association

was very often at the buyer's mercy especially when the buyer was unscrupulous. Not only was the reputable contractor who was trying to install his graded material in a high-class manner at the mercy of the buyer, but he was at the mercy of the ignorant contractor, who because of lack of education or lack of application did not know what his costs for a given piece of work would be. This class of competition, when it found that a job was running in such a way as to lose money for the contractor, was prone to try to make up the deficit by skimping either on material as in the amount of radiation installed or on the workmanship.

"'Certified heating' not only grades the product of the contractor but it grades the contractor himself and removes the able honest contractor from the harmful competition of the ungraded heating man.

"The best evidence of the superiority of those contractors, who are giving their community certified heating, is



Seal of Los Angeles Association

seen in the progressive methods adopted by their association."

In order to get the idea before the public the Memphis Association of Heating and Piping Contractors distributed circulars in connection with an exhibit the association maintained at the Tri-State Fair and offered $50 in cash prizes, having each contestant register his name and giving a numbered circular, the cover of which is the duplicate of the tag fastened upon the firebox of every boiler installed under the certified plan. Inside of the pamphlet appeared the guarantee of the association, as follows:

"This association guarantees the work of its members and will adjust without charge any complaint regarding defective workmanship or materials or overcharges. Address all complaints to the association, giving all details. Membership in this association is open to all heating contractors who will conform to its standard of practice and who will devote time to self-education and advancement."

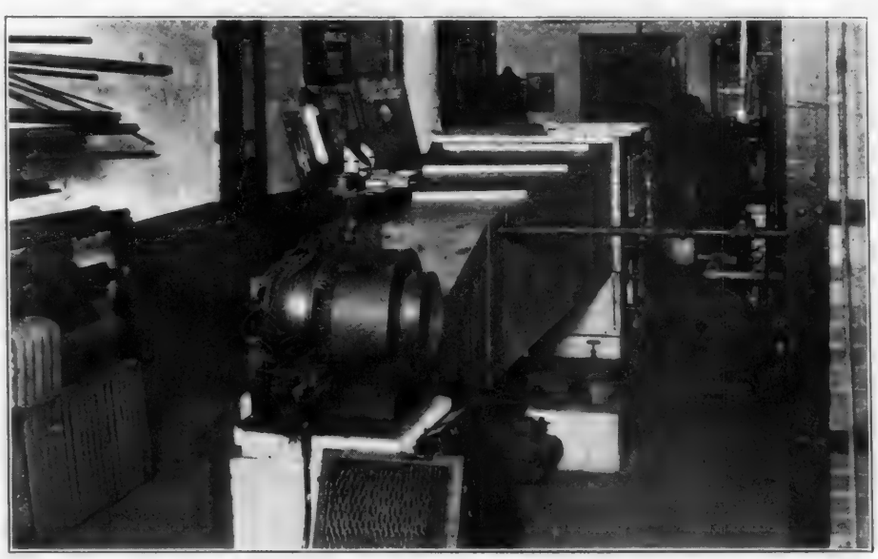
On the third page a list of the members from whom the "Certified Heating" service can be obtained was given. In this way the association obtained a list of 3,000 names which will be used for direct-mail advertising.

The Los Angeles (Cal.) Association has the honor of introducing "Certified Heating" to the home builders of the Pacific Coast. It has adopted a seal for the use of the association and its membership in exploiting "Certified Heating."

Exhibit of Heating and Plumbing Apparatus at Carnegie Institute of Technology

Twenty manufacturers of heating and ventilating and plumbing apparatus were represented in the exhibit at the Carnegie Institute of Technology, Nov. 12–14, held in connection with the three days' course of lectures and demonstrations conducted by the institute. One of the set-ups which attracted especial interest was an experimental Carrier air conditioning apparatus, shown in the accompanying illustration.

Other exhibits were made by the National Tube Co., Pittsburgh Water Heater Co., Peerless Heater Co., Pittsburgh Engineering Co., Standard Sanitary Mfg. Co., Pittsburgh Meter Co., United States Radiator Corp., Williams Gauge Co., Pittsburgh Valve & Construction Co., A. M. Byers Co., Kelly & Jones Co., Achisen Brass Co., Automatic Gas-Steam Radiator Co., Troop Mfg. Co., Universal Sanitary Pottery Co., and William Scaife Co. Additional exhibits were made by the Carnegie Library of Pittsburgh and the National Trade Extension Bureau.



Carrier Air Conditioning Apparatus at Exhibit of Material Manufactured in the Pittsburgh District, at Carnegie Institute of Technology

British Heating Research Work at a Critical Point

How critical a point has been reached in the research work of the (British) Institution of Heating and Ventilating Engineers, was brought out at the recent autumn meeting of the association, in London, October 14, when Edgar Herring, chairman of the Research Committee, made his report. Since the midsummer meeting, he stated, the subscriptions had fallen considerably short of the sum required, £300, which was necessary to secure the government grant of an equal amount. He expressed the belief that it would soon be a case of "sounding the last post" and letting the investigations at the University College drop, at least temporarily.

Among the proposals put forward was one to increase the membership dues. It was finally resolved, however, to take steps, when the next membership dues became payable, to ask for special contributions towards research work.

For the Boiler Rating Committee, Chairman W. W. Nobbs stated that the testing of boilers at University College was in full swing and 20 recorded tests have now been made. One of the tests was the determination of fuel consumption and temperature rises under predetermined conditions. Other investigations under running and banked conditions are being planned and it is hoped to tabulate results for presentation at the next meeting of the institution in February.

In the election of new officers Alcwyn A. Jones was unanimously chosen as president. Mr. Jones began his business career as an architect and it was while he was active in this work that he became interested in heating and ventilation. Through his association with A. H. Barker, Mr. Jones took up scientific and research work and participated in a number of the investigations being conducted at University College. Since his election to the institution in 1910, he has served on several of its committees, including research and boiler rating. He is the author of two papers presented before the institution, one on "The Coefficients of Heat Transmission Established by the Austrian Engineers" (1916), and one on "Heat Emission from Radiators," (1921).

SAFETY VALVES APPLIED TO HEATING BOILERS

The technical session of the meeting was devoted to the presentation of a paper by H. A. Stirzaker on "Safety Valves Applied to Heating Boilers." The more or less haphazard methods of determining the size of safety valves on heating boilers, he stated, was a matter requiring the immediate attention of the institution, with a view of framing suitable rules for the guidance of its members and the industry in general.

Mr. Stirzaker stressed the necessity of having a safety valve which could be guarded against unauthorized alteration in its setting, and cited instances of how the weighted lever type lent itself to abuses of this nature. In one case, he stated, he found such a lever serving as a coat hook and in other cases additional weights had been added to increase the working pressure, without the knowledge of those responsible for the operation of the plant.

Objections were also raised to the dead-weight type of valve on the same ground, namely, that it could readily be tampered with. Its large size and ungainly proportions were other points brought out as unfavorable to this type.

"It would seem, therefore," continued the speaker, "that of present-day design the most suitable type is the spring-loaded valve, efficiently locked or otherwise secured against unauthorized alteration in its original setting, but at the same time designed so that the valve could be turned upon its seat, and of being eased from its seat without disturbing the locking gear. The material used in its construction should be of non-rusting or non-corrosive nature as far as possible, the valve chest should be efficiently drained so as to prevent the water of condensation accumulating in the chest, and the waste steam passages so arranged that the escaping steam did not come in contact with the spring and upper working parts.

The cover guarding the spring should be so designed that it would not be possible for small foreign articles, such as nuts, etc., to enter the cover and interpose themselves between the coils of the spring.

Provision should also be made in all cases for carrying away waste steam from the immediate vicinity of the boiler, for if this is not done, a sudden lifting of the valve might easily cause a nasty accident to anyone standing near the boiler.

It was usual practice in the heating industry, continued Mr. Stirzaker, to fit safety valves on water boilers of a much smaller size than those on steam boilers, the argument being that the release of a very small quantity of water effectively reduced the boiler pressure. This was perfectly sound reasoning providing there was no stoppage between the feed apparatus and the system, but should the makeup water fail through the action of frost or other causes, it was conceivable that the plant might approach the working conditions of a steam system.

In certain cases, where more than one boiler was installed, said the speaker, it was fairly common practice to fit each boiler with a valved flow and return, the object being to allow one boiler to be used as a spare, or to permit one boiler being cleaned or repaired while the others were in commission. Such valves, in the first instance, were generally supplied with chains and locks, so that the valves on the working boilers might be locked open. After a few months, however, it was not unusual to find the chains missing or lost and in these circumstances the possibility of a boiler being started up with the valves closed was not very remote. The need of an efficient safety device in such a case, he pointed out, was obvious.

Mr. Stirzaker concluded his paper with the accompanying table giving the approximate amount of steam discharged by safety valves in pounds per hour at various gauge pressures, although he stated that the figures were probably on the low side:

This was followed by a summary of the rules governing the size of safety valves in marine boilers, adopted by the Board of Trade. In this connection the author called attention to the fact that previous to 1919-1920, the various bodies in England having jurisdiction had different methods of calculating the size of safety valves, but in July, 1919, a conference was held which led to the formation of a uniform set of rules, following closely the recommendations of the British Marine Engine Design and Construction Committee. These rules have now been adopted by the Board of Trade and supersede the board's previous rules.

DISCHARGE OF STEAM IN POUNDS PER HOUR THROUGH SAFETY-VALVES AT VARIOUS BOILER PRESSURES.

Size of Valve.	Gauge Pressures lbs. per sq. in.							
in.	2	5	7	10	25	50	75	100
1	31	48	57	68	101	165	226	294
1¼	46	75	88	106	157	250	350	450
1½	70	108	128	153	226	370	505	650
2	125	192	228	272	403	660	900	1170
2½	195	300	356	424	630	1050	1400	1820
3	278	430	510	610	900	1465	2010	2600
4	496	765	910	1090	1605	2620	3509	4650
5	780	1200	1420	1700	2500	4100	5600	7275
6	1120	1740	2040	2440	3620	5900	8100	10500

Above figures calculated for a valve lift of $\frac{1}{40}$th of the valve diameter.

Progress of the Anthracite Economy Service Campaign

Satisfactory attendance and a growing interest in the campaign of the Anthracite Economy Service to promote a wider use of the small sizes of hard coal are reported by the Anthracite Coal Operators, who are back of the campaign. Already the Anthracite Economy Service exhibit has been shown in Portland, Me., Manchester, N. H., Providence, R. I., Worcester and Springfield, Mass., and Hartford, Conn. The itinerary from there is New Haven and Bridgeport, Conn., Albany, Syracuse, Rochester and Buffalo, N. Y., Paterson, Newark and Trenton, N. J., Allentown and Lancaster, Pa., Baltimore, Md., Wilmington, Del., and Atlantic City, N. J.

In addition, the Anthracite Coal Operators' five service stations in New York, Brooklyn, Philadelphia, Boston and Washington, are being maintained, each of which reports great strides in educating the public in the various methods of heating a home, with special reference to the economies possible with buckwheat and similar sizes of anthracite coal.

The following suggestions, based upon government suggestions, are endorsed by the Philadelphia Anthracite Bureau of Information:

Order at least one ton of small coal to three tons of large. You will get quicker delivery and save money.

Do not mix the large and small coal. Keep each size in a separate bin.

Keep a layer of ashes on the grate to prevent the small coal from falling through.

The smaller sizes should always be used for banking the fire at night or when a low fire is wanted in moderate weather.

After the fire is shaken down for the night, put on a small quantity of the larger coal and then bank the fire with a light top dressing of pea or buckwheat. This tends to hold the draft and aids in the proper and economical combustion of the coal body as a whole.

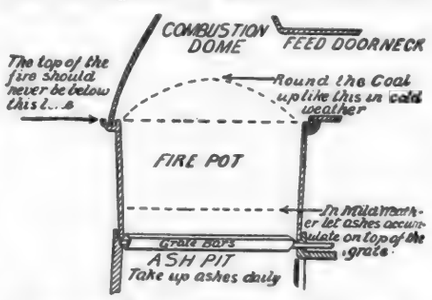
When a light layer of buckwheat is used for banking purposes, the regeneration of the furnace in the morning is hastened, as the smaller coal ignites more readily when the draft is turned on, and thus helps the ignition of the larger coal.

In the morning the furnace should be shaken down, but only until a glow appears in the ash-pit. The grate should never be shaken so vigorously that burning coals escape through the grate bars. Fire with some of the regular coal and when the fire is burning well it can be checked or banked with some of the small coal as a top dressing.

Fire the furnace with the two sizes in layers. In mild weather larger quantities of the small coal can be used; in severe weather it is advisable to use the small coal for banking purposes only.

The exact proportions of large and small coal should be determined by experience and by weather conditions. Give your heating apparatus intelligent study and attention. It will repay you.

Use the check damper to check the draft at night or in moderate weather.


COMBUSTION DOME
FEED DOORNECK
The top of the fire should never be below this l...e
Round the Coal up like this in cold weather
FIRE POT
In Mild weather let ashes accumulate on top of the grate
Grate Bars
ASH PIT
Take up ashes daily

How to Feed a Fire in Mild and Extreme Weather

Don't leave the feed door open to effect this result.

Keep the ash-pit clean. If ashes are permitted to remain in the ash-pit the grates will soon burn out.

Keep heating surfaces clean. Much heat is wasted if dust is permitted to collect on the boiler tubes.

Keep waste pipe and chimney flue clean.

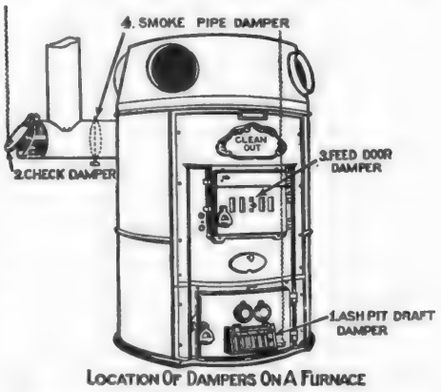
REDUCE YOUR COAL BILLS
VISIT THE ANTHRACITE ECONOMY SERVICE EXHIBIT
AT SPRINGFIELD, MASS.
ADMISSION FREE
Experts Will Solve Your Heating Problems
Instructive Exhibits of Coal-Saving Devices
Interesting Motion Pictures and Displays
BURN BUCKWHEAT - THE CHEAPEST FUEL

Anthracite Economy Service Traveling Exhibit

HOW TO ADJUST THE DAMPERS

No. 1, the draft damper, is usually a lift door or a slide, or both, in the ash-pit door, and through which nearly all the air necessary for the combustion of the coal is admitted.

No. 2, the check damper, is placed at some point in the smoke pipe and when open checks the combustion by admitting cold air into the pipe. This damper should always be closed when fresh coal is added to the fire.



LOCATION OF DAMPERS ON A FURNACE

Illustration Used to Show Proper Operation of Furnace Dampers

No. 3, the feed-door damper, is intended when open to check combustion by admitting cold air directly over the fire, and cools the heated gases before they are properly burned. It may be only partially open so as to supply sufficient air to supplement that taken through the fire bed, and thus effect a proper combustion. Its regulation varies with different conditions and adjustment must be determined by experiment.

No. 4, the smoke pipe damper, is not essential, but is of value when the chimney has a very strong draft, by giving more effective control than can be had with the check damper along.

Heating Equipment of Modern Apartment Hotels

Some interesting notes on the practice followed by many engineers in the design of heating apparatus for the modern apartment hotels are contained in an article by J. F. Musselman, M. E., a well-known New York consulting engineer, on "Mechanical Equipment of Apartment Hotels," appearing in the current issue of the *Architectural Forum*.

"The system of heating," states Mr. Musselman, "usually selected for tall apartment hotels that is called, through courtesy, a modulating steam system. The fact that with such a system the temperature cannot be modulated does not seem to have detracted from the popularity of the name. At any rate it is the best we know for such a building, and has marked advantages over the one-pipe steam system that was once in general use. For the low and long drawn out building, no other system of heating has as many advantages as forced circulation hot water. It is economical in opera-

tion, not excessive in first cost, and is readily adjusted to the idiosyncrasies of the weather.

"Whatever the system of heating may be, the requirements in the way of boiler plant are about the same. On account of the requirements of a steam kitchen for the restaurant and probably a steam laundry, it is necessary that at least part of the boiler plant be operated at medium pressure, that is, from 60 to 100 lbs. On this account it is generally desirable to operate all boilers of the plant at medium pressure, which can be done with the same efficiency and considerably simpler piping arrangement.

"Too often in buildings of this kind the boilers are crowded into whatever space happens to be left after other requirements have been met. It isn't the question of ease of repairs only, but the ever-present operating costs that make a properly located and adequate boiler room imperative. It should be correctly located, relative to the fuel and other parts of the mechanical plant as well as to the load, and should have sufficient height and area to make crowding unnecessary.

"The kind of fuel to be provided for is that which will secure the minimum total cost of generating steam at the time the building is constructed. But this is likely to change with the changing prices of fuel, so as a safety precaution it is well to so arrange the equipment that coal can be substituted if oil is used, or the reverse. As a rule no extension system of automatic temperature control can be afforded in a building of this type, on account of the fact that the first cost of the building is given more serious consideration than the cost of operation. There is little doubt but that a simple, reliable, inexpensive system of temperature control on every radiator would be a good investment for any such building.

"More ventilation is required in an apartment hotel than in an apartment house—which as a rule has almost none at all. The restaurant and its kitchen must be ventilated in the same way as those of a hotel, for if this is not done, the odors of food will find their way immediately to the tenants' suites. Other public portions of such buildings are generally provided with no ventilation. The baths, if they have no windows, must have an exhaust system with either high velocity in the flues and a fan on the roof or with larger flues and a gravity ventilator. The fan, if used, depends for its usefulness on the inclination of the operating engineer to keep it running, while with the gravity ventilator one assumes that the wind will always blow; neither premise is altogether sound. The individual kitchenettes of such a building, opening, as they usually do, directly into the living rooms, imperatively require positive and ample exhaust ventilation in order to control the cooking odors. This can be best effected by connecting each range hood vent to a general vent flue, in which positive air velocity is always maintained. With wall beds or door beds that fold up in closets or unexposed dressing rooms, it is undoubtedly advisable to exhaust some air in such a way as to cause a circulation around the beds."

Ventilation as a Business Getter

The importance and the business-getting value of a supply of good air in the conduct of a first-class hotel is discussed in a practical way by Arthur L. Greene of the Buffalo Forge Co.

Mr. Greene cites two instances illustrating his point.

"A large hotel in an eastern city" he says, "with an up-to-date ventilating installed, recently served a banquet for an association convention of some 700 members. The hall in which the banquet took place is large and easily capable of serving this number. After dinner, with 'smokes' lit and windows and doors closed to prevent outside disturbance, the members sat back to enjoy a group of select speakers.

"Of course, you know what happened! By this time the cigars and cigarettes were well under way and the speaker could be seen but dimly. The air became heavy and stagnant, collars and starched shirt fronts began to wilt and an increasing consumption of ice water testifying to the heat and discomfort, was at once evident.

"One of the guests in hopes of obtaining relief and not being able to locate the manager, assistant manager, or chief engineer, was shown to the assistant engineer's office. The situation being explained, the banquet hall ventilating fans were started at half-speed. Some time later the hall again becoming warm and uncomfortable, the guests discovered that the fans had been turned off. In other words, the management of this hotel, after spending the money necessary to install an efficient ventilating system, nullified the effect of the outlay and created a host of uncomfortable patrons through a false idea of economy.

"We turn now to an even more modern, larger and better-equipped hotel in the same city. Following a three-day business session of a national organization held at this hotel a short while ago, a banquet was given for the members and their families. At the conclusion of the very excellent banquet served in a sumptiously appointed hall, the 1,000 or more guests—the great majority of whom were from out of town—prepared to listen to several nationally-known speakers. Nothing apparently could dampen the guests' enthusiasm. Suddenly, however, and without warning a cold draft swept over the room. A hurried scramble ensued on the part of the male members to obtain cloaks and coats for the ladies from the cloak-room, while others, not so conveniently situated to the door, had to make the best of a bad situation by draping napkins and newspapers around the ladies' shoulders.

Electric Heating of the Residence

An interesting application of electric heat was recently made in heating residences in California. One installation is being built in a large residence in Southern California and another has been included in the specifications for a $30,000 residence now being built in Santa Barbara.

The heaters used are General Electric sheath-wire air-heating units. They are installed in special galvanized-iron boxes, permanently mounted below the floors or in the walls, and covered with regular, register gratings. The heaters are of the recirculation type so designed that the air passes from the floor of the room down all four sides of the heater-box outside of a special chimney surrounding the heating units.

The air is then returned to the room through the chimney, being heated as it passes over the units.

4-K.W. Heater Equipped with G-E. Air Heating Units, 14 in. Wide 25 in. Long
(Top View, Grating Removed)

National Trade Extension Bureau

Annual Conference of Sales and Advertising Managers

Sales and advertising managers in the heating and plumbing industries met in annual conference, November 5–7, at Evansville, Ind., under the auspices of the National Trade Extension Bureau. Included in the subjects discussed were exhibits and show window displays, catalogue standardization, apprentice training, T. E. B. helps and what they consist of, selection and training of salesmen, selling fixtures for the contractor's store, how the U. S. government will help the plumbing industry in determining a potential market, government literature available pertaining to heating and plumbing, co-operative advertising, how to get the heating and plumbing contractor to co-operate in direct-by-mail advertising, the value of film advertising showing manufacturing processes, the value of display booths at fairs and building shows, the value of group advertising, selling on easy payments, the value of trade paper advertising, the advantage of displaying price tags, the development of better relations between branches of the industry, and the results of the T. E. B. monthly sales campaign.

A report by William J. Woolley, secretary-manager of the bureau, went into many branches of the work and gave evidence that the heating and plumbing industries are forging ahead, due in no small part to the aids originated by the bureau.

Statistics were presented by M. W. Lansing, of the Trenton Potteries Company, showing that there has been an impressive increase in the number of fixtures sold for window and showroom display.

Government plans for determining the potential market in the plumbing field were outlined by Charles Thorndike of the U. S. Department of Commerce. He stated that it was the intention of the government to analyze existing data, such as sanitary conditions, census reports, kinds of people, income taxes and purchasing power of the people. From these will be drawn conclusions to show the relative possibilities in the various sections of the country. This report, it was stated, will soon be ready for distribution and will no doubt offer suggestions for a similar analysis, either by the National Trade Extension Bureau, or by some other body, of the potential sales possibilities in the heating industry.

Opportunities in a national co-operative advertising campaign, outlined by Charles Wagenseller, of H. Mueller Mfg. Company, resulted in the appointment of a special committee to work with the existing committee in formulating a publicity campaign to be submitted to the bureau membership.

What other industries are doing to develop sales was discussed by Will H. Howell, of Will H. Howell and Associates, and covered such topics as house-to-house convassing, practical demonstrations and close co-operation between manufacturer and dealer. One of his points was that competition is not confined by any means to the industry itself but extends to every other industry which is competing for the buyer's dollar.

Selling on time payments and the possibilities of such a practice were explained by Frank L. Chance, of Henri, Hurst & McDonald, advertising agents. He told of the experiences of other industries which have adopted the partial-payment plan, and showed how it could be a source of profit to both buyer and seller.

The Apprentice Situation

While considerable progress has been made by the National Trade Extension Bureau in developing an educational system for apprentice plumbers, only a tenth as many schools have been established for the heating and ventilating industry. This, in the opinion of E. L. Bowman, the educational director of the Bureau, is due to the policy of the Heating and Piping Contractors' National Association in considering such training one of local, rather than national concern. As a consequence, only a few communities have established schools for certified steam fitters' helpers and apprentices.

Because of the fact that the Heating and Piping Contractors' National Association has not appropriated money for the purpose, it has not been possible for the National Trade Extension Bureau to attack the problem of writing text material for the certified steam fitter's helper. Mr. Bowman believes that something must be done at once to provide for steam fitter helpers the same technical training and the same conditions of apprenticeship as in the plumbing trade. A national viewpoint it is urged, must be developed. Then, it will be possible to establish schools, numbering one-half as many as those in the plumbing field. It is hoped that a handbook will be in print by January, 1925, so that committees desiring to establish schools may duplicate the work of the seventy-odd communities now maintaining schools.

The future is bright, Mr. Bowman holds, since methods have been developed, relationships have been set up, experiments have been tried and the Bureau is now ready to proceed on a national scale in the organization of community schools for apprentice plumbers. With the co-operation of those in the field and the valuable experience that has already been gained it is expected to take but a short time to develop such an educational system as the National Trade Extension Bureau has in view.

Inauguration of T. E. B. Apprenticeship Service Department

Acting on the slogan of "an apprentice in every shop and every apprentice in school," the National Trade Extension Bureau announces the inauguration of an Apprenticeship Service Department by which the master plumbers in the small cities and towns may provide schooling for their apprentices.

In cities of 30,000 to 50,000 and upward, where there are twelve or more apprentices, classes organized under the Smith-Hughes act may obtain technical training if their employers request it of the public schools. A survey recently completed by the Apprenticeship Service Department of the Trade Extension Bureau proves that more than half of the master plumbers of the country are located in cities and towns too small to maintain resident training classes for apprentices.

At the last convention of the National Association of Master Plumbers in West Baden in June, it was unanimously voted to install a division of correspondence study for apprentices in the Apprenticeship Service Department of the bureau.

In accordance with this action, the bureau's Correspondence Training Division has been organized, with George K. Wells as division chief. Self-help manuals will be prepared to show the apprentice how to study the Standardized Course of Training for Apprentice Plumbers. Provision is being made for the handling of records, correction of papers, testing of results and granting of certificates earned by apprentices. It is hoped to have the course in operation by next January.

According to present plans, apprentices will be enrolled providing they can show that they are bona fide learners of the trade and have their employers' consent and indorsement. Application blanks will be sent to those who write the bureau for them.

When the application blank is received, with the proper signatures and with the first payment of tuition, the apprentice will receive the student's outfit, including a general manual explaining the plan. He will also receive two or more of the instruction pamphlets, with self-help booklets telling him just how to study them.

When he has completed the first unit, he will mail his papers to the bureau in an envelope furnished as part of the supplies. His papers will be corrected and the grade he makes will be recorded. Suggestions will be given him for improvement of his study.

When the corrected papers are re-

turned to the apprentice, he will receive an advanced lesson pamphlet and the self-help manual which accompanies it. Thus he will always have plenty of work on hand, and will not be delayed in carrying on his studies. The self-help manuals will be supplemented where necessary with personal help letters.

New T. E. B. Membership Seal

A new supporting membership seal has been adopted by the National Trade Extension Bureau. Manufacturers and wholesalers who support the bureau are asked to use the seal in all advertisements, and in their catalogues, letterheads and other printed matter. It is supplied in three sizes.

The Business of Heating

In a New Year's message addressed to the heating industry, Secretary Henry B. Gombers of the Heating and Piping Contractors' National Association, has some interesting comments to make on some of the major activities of the association.

Discussing, for instance, the radiation tables adopted by the association and its efforts in behalf of better boiler ratings, he states:

"The officers and members of the Heating and Piping Contractors' National Association may justly compliment themselves on the accomplishments of the national association during the past year.

"Just to mention two features of our work: The publication of 'Standard Radiation Estimating Tables' for twenty important cities ushers in a new day of more exactly figured quantities in the estimating room and accomplishes this with a time and labor-saving device that relegates the old rules to the scrap-heap.

"We are proud of this work of our Committee on Standardization, based as it is on the best engineering data available, yet simplified to a point that makes it available for use wherever radiation is figured. That the heating industry appreciates these tables is evidenced by the demand from all parts of the country for the sheets.

BOILER RATINGS

"Then the question of boiler ratings was discussed and a special committee of five members was appointed to obtain uniform dependable ratings. So much progress has already been made that it seems safe to predict that a satisfactory solution will be found early in 1925.

"Whatever else may be accomplished by settling the question of boiler ratings (and the heating contractor knows how much will be accomplished by stable ratings) from an association standpoint one of the most important results is the spirit of co-operation and confidence built up between the manufacturers and the contractors.

CERTIFIED HEATING

"As one after another of the progressive local associations affiliated with our national association introduces the community it serves to 'Certified Heating,' there is built up across the country a new confidence in the ability and integrity of the heating contractor which is a business-building factor to be reckoned with.

"During 1925 we look for a continuance of the spreading of 'Certified Heating' throughout the United States as the local groups realize how much easier it is to institute this service, using the results of the work of the Committee on Standardization as the basis of the plan.

"This building of confidence cannot help but increase the volume of work done and benefit all the various elements of the heating industry. The heating and piping contractor and manufacturers of heating material can definitely and consciously advance this growth of confidence by co-operating to discourage the entrance of incompetent contractors in the industry and by warning the buying public that good material is only half of a good installation, the rest of the good installation being a combination of skill in design and skill with tools that can be expected only in the organization of the established reputable heating and piping contractors."

Survey Shows Continuation of Building Shortage

That a building shortage of great magnitude exists in this country was brought out very comprehensively in a survey made by S. W. Straus and Co., New York. The amount of this shortage is estimated to be in excess of $4,000,000,000.

The survey which covered 528 cities, all of over 100,000 population, showed a lack of housing facilities in 380 cities. In the balance, the building operations were ample to take care of the growing need.

The eastern section reported total shortages amounting to $2,312,510,000, of which $1,652,887,500 was residential, $439,220,000 commercial and the rest public. The central States responded with figures of smaller magnitude for residential buildings and higher for commercial and public, a total of $1,149,700,000. The southern States show a total of $307,495,000, distributed as follows: residential $83,425,000, commercial $137,515,000 and public $86,555,000. The western States reported shortages of only $281,115,000 of which $117,840,000 affected public buildings, with the balance fairly evenly divided between residential and industrial.

Of the 25 leading cities, New York leads with $855,000,000, the greatest part of which is needed for residential type of buildings. Chicago is second, with a shortage of over $500,000,000. No shortage was reported in Boston, Baltimore, Washington, New Orleans, Minneapolis, Kansas City or Jersey City.

Western Society of Engineers Investigates Free Engineering

Conditions in the engineering field which affect the engineer and the public, namely the furnishing of so-called free engineering in connection with the sale of material and equipment entering into engineering structures, have been made the subject of a special investigation by the Western Society of Engineers, whose headquarters are in Chicago.

The basis of the investigation was a memorandum received by the board of directors of the society which read:

"It is now possible for the architect or owner to have (free?) engineering designs prepared by the contractor or organizations furnishing material or equipment, as follows:

"STRUCTURAL DESIGNS by the bar companies and structural steel fabricators;

"HEATING DESIGNS by the contractor or manufacturer of heating specialties;

"VENTILATING DESIGNS by the contractor or manufacturer of ventilating equipment;

"ELECTRICAL DESIGNS by the contractor, manufacturer of electrical equipment or by the public service corporation furnishing current;

"PLUMBING DESIGNS by the plumber.

"Similar conditions exist in connection with nearly all equipment and material required.

"Even when engineers in private practice furnish the designs, it is occasional practice for the architect to avoid paying engineering fees on their work by specifying that the contractor shall pay most if not all, of the engineers' fee under the guise of 'Shop Details,' 'Construction Details,' or 'for checking Shop Details.'

"In the case of a large building recently constructed in Chicago it has been reported that the structural design was paid for by the contractor furnishing and placing the forms.

"It is not the purpose of this memorandum to enter into a discussion of the propriety or impropriety of such practice but it is felt that if such method is proper from the standpoint of efficiency and economy, it should be done in the open, so that the owner will know what and who he is paying for engineering services."

The committee, which has been given the title of the Committee on Free Engineering Service, is composed of Henry J. Burt, chairman; C. B. Burdick, W. J. Lynch, R. G. Rosenbach and Linn White.

THE STATE OF BUSINESS

Outlook Uniformly Good

Stock Exchange Boom No Representative of Nation's Economic Condition. Good Christmas Business Expected

Especially Prepared for the THE HEATING AND VENTILATING MAGAZINE

By L. W. Alwyn Schmidt

WE SHALL do well, not to take at its full face value the demonstrative activity of the stock exchanges, following the announcement of the result of the election. Such exceptional high transactions in the security markets no doubt make for high clearing house figures during the following months, but they have no influence whatever upon the real economic situation of the country. This had turned for the better already sometime before the election.

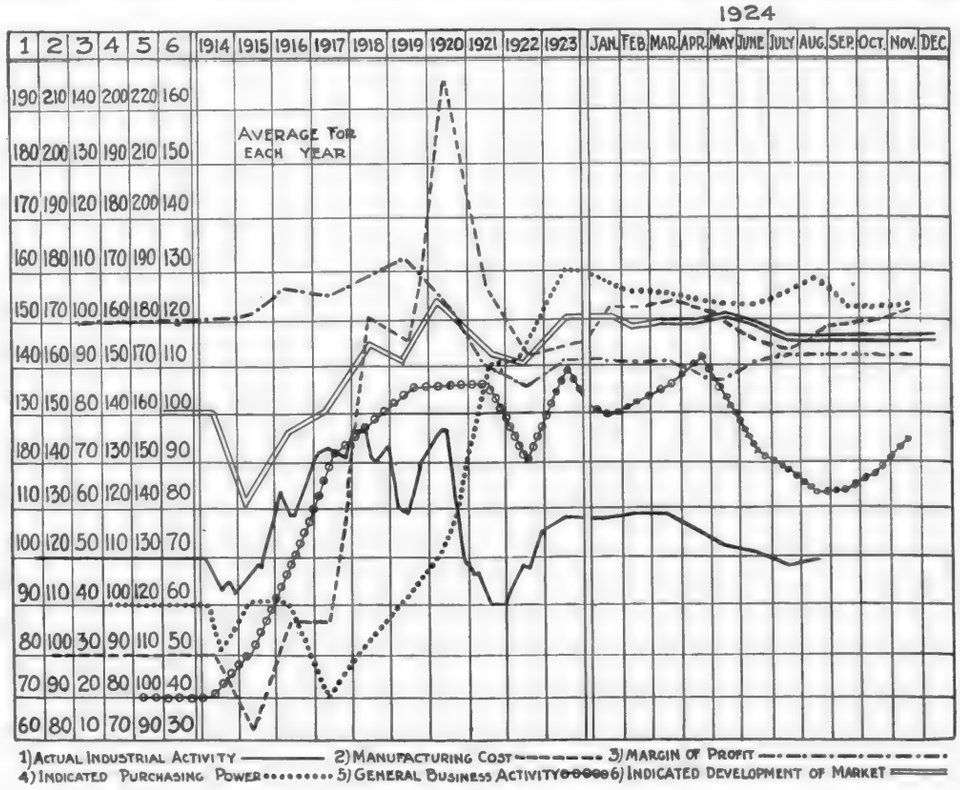
There has not yet been invented a political party which will let it rain when the corn needs rain or give us dry weather during the hay crop. Neither have we found as yet a cure for low or high prices by way of a political slogan. In fact, the influence of politics upon business appears to be more or less negative. If any deduction, therefore, can be drawn from the outcome of the recent election at all, it is that it will not negative the present healthy development of the market, but will leave it very much where it is. In addition, business men no doubt will welcome the intention of the President to give business a legislative rest.

Economic recovery after having taken a firm hold upon the western markets now begins to show its effect upon employment in the east. We have held all along that the recent decline did not result from any structural weakness of the market, but had its sources rather in the habitual receding movement following the rise of an economic wave of unusual force. This movement at the worst had to be of comparatively short duration.

Unemployment certainly was very considerable during a few months, but even this conceded, it appears that the actual volume of production has been much higher than indicated by the employment statistics. Fewer men are required to-day to keep up a given rate of production than compared with 1914 which forms the basis of official employment statistics.

The most outstanding feature of the present situation is its general steadiness. Rapid changes in the condition of the market produce as a rule violent fluctuations of the recognized indicators of market strength. But neither the sudden decline nor the more sedate upward movement have disturbed materially this time the balance of the market. This condition naturally cannot continue indefinitely and over short or long adjustments will become imperative.

So far, increases in the price of one commodity have been counteracted by decreases in another. But the increasing demand for industrial raw materials no doubt will force an early upwards movement all along the line. Prices of raw materials will be higher


1924
1 2 3 4 5 6
1914 1915 1916 1917 1918 1919 1920 1921 1922 1923
JAN. FEB. MAR. APR. MAY JUNE JULY AUG. SEP. OCT. NOV. DEC.
AVERAGE FOR EACH YEAR
1) ACTUAL INDUSTRIAL ACTIVITY
2) MANUFACTURING COST
3) MARGIN OF PROFIT
4) INDICATED PURCHASING POWER
5) GENERAL BUSINESS ACTIVITY
6) INDICATED DEVELOPMENT OF MARKET

Analysis of Business Conditions at End of November

at the end of the present year, than they are just now. This in turn must have an effect upon manufacturing cost.

How will industry deal with this development? Will it feel sufficiently strong to pass on the cost increase to the consumer or will it think it a wiser policy to absorb it by improved production methods and leave retail prices where they are? For the present opinion inclines to the latter course. So we may have to face another reduction of industrial profits during the next few months.

In solving this particular market puzzle, manufacturers will have to study the condition of their customers. Employment is on the increase again and with it there will also be a corresponding increase in purchasing power. But unemployment has been widespread during the last half year. Its effects will make themselves felt for some time to come until the wage earner and salaried man have caught up with their financial losses for the past summer.

Let us keep in mind that high wages by themselves are not the sole factors in determining national purchasing strength, but that with it must be taken into consideration the existence and prospect of regular employment. Irregular employment forces the wage earner to lay by for the rainy day and makes him cautious as to expenditures. Lack of employment lays the stress of supporting the family upon a smaller number of wage earners, reducing in this manner the spending power of the individual.

Both together have a considerable influence upon the national purchasing power and will make it necessary, for a while at least, to follow a conservative price policy. This apparently has been realized by retailers and manufacturers alike with the results that Christmas quotations do not show any advance over autumn prices.

The Christmas buying season has opened rather quietly, which is due almost entirely to the unseasonable weather which was prevalent late in November. But the general resumption of all industrial and commercial activities, now fully under way, will have its effect upon Christmas purchases and with the event drawing nearer business is bound to become increasingly active. Following as it does upon a period of retrenchment, buying may even turn out to be unusually heavy, as is frequently the case after the passing of a severe economic strain.

The outlook appears to be uniformly good.

Steam Saving in the Hoge Building, Seattle

An account of the steam savings effected in the Hoge Building, Seattle, Wash., which appeared in THE HEATING AND VENTILATING MAGAZINE for September, contained the statement that this building was heated by the Northwestern Electric Company. We are informed that this is an error as the building is on the lines of the Puget Sound Power & Light Company, of Seattle. It was also stated that the heat saving obtained through the use of temperature regulation, with the thermostat placed in one of the offices on an upper floor of this 16-story building, came to 26%. We are informed that this statement should read: "With the heat regulator installed, the steam was shut off 26% more of the time than they had been able to operate it under manual control." This means that the actual saving was not 26%, but slightly under that figure. Of course, even a saving of 20% on a 16-story building of this type would pay for itself in a short time.

Typical Examples of Economy With Insulation

Three different uses of insulation which effected substantial savings in operation costs, are suggestive of the possibilities in this direction. A tank of 120-gal. capacity, connected with an International No. 3 water heater, required one ton of hard coal every two months to keep the water at 160° F. or higher for the use of two families. A square form of sheetrock was built around three sides of the tank, the fourth side being the foundation brick wall of the building. The sheetrock started flush with the bottom of the tank, about 2 ft. above the floor and ended at the top of the tank. Insulex was then poured into the form which was left in place. One ton of hard coal every four months is now required to keep the water above 100° and the heater is operated 23 hours a day with a banked fire, check draft open and chimney damper closed. At all times, it has been found, the sheetrock is cool to the touch and the cost of the sheetrock and Insulex was $5.00 and two hours' labor.

The success experienced with this hot-water tank led to the insulation of a Hart & Crouse No. 20 water boiler. Around this boiler was built a square form of sheetrock from the floor to the top of the boiler, excepting the front side where the ash-pit, clinker and fire-doors were left uncovered. About 6 in. of Insulex was poured and set at the top of the boiler and the thickness of the Insulex fill at the center of the sides was 4 in. After being insulated in this fashion, the boiler was found to require considerably less fuel to maintain a water temperature of 205° than was necessary to maintain 160°, the maximum reached at any time before the boiler was insulated.

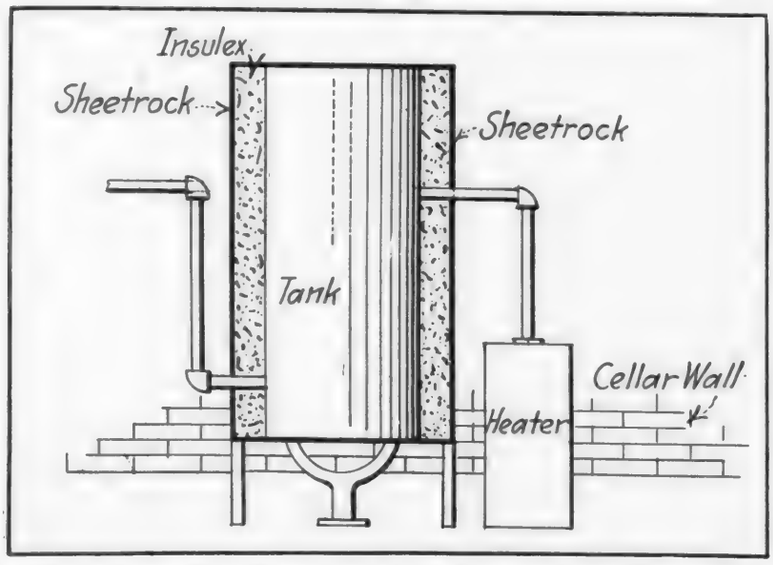
INSULATION OF A SUN PORCH

The insulation of a sun porch transformed what had been the coldest room in the house to the warmest, with a temperature of 70° F. with an outside temperature of —22°. The floor was 4 ft. above the ground and the side walls were 3 ft. high on two sides, with glass above the two walls. Insulex was placed under the floor and also in the sides, studs and ceiling at a cost of $30.00 for the material.

The Department of Commerce and American Business

The United States Department of Commerce has been eminently successful in helping American business during the last three years. Under the leadership of Secretary Hoover, the personnel has been strengthened, new work undertaken and work already in progress rapidly advanced.

On September 23 a committee of three of the National Conference of Business Paper Editors waited on Mr. Hoover and obtained in detail information concerning the work of the Department of Commerce with relation to American industry. A report of the meeting has been published and dis-



Hot Water Tank Insulated with Sheetrock and Insulex

tributed to members of the conference. A summary of those activities of Mr. Hoover's department that are directly beneficial to the heating and ventilating trade may be taken as an index of the importance of the work accomplished.

The Division of Simplified Practice, established early in 1921 by Secretary Hoover, "serves as a centralizing agency in bringing together producers, consumers and distributors, when so requested by any of these groups, for the purpose of assisting these interests in their mutual effort to eliminate waste in production and distribution." The elimination of superfluous sizes and unnecessary variations in dimensions of common commodities was the first step of this bureau.

For example, range boilers have been reduced from 130 varieties to 13, forged tools from 665 to 351, asbestos paper widths from 3 to 1, and weights 8 to 5; hot-water storage-tanks from 120 to 14 and steel reinforcing bars from 40 to 11. Simplification of gas water-heaters; steam-boiler parts and fittings; taps and dies; shovels and furnace parts is underway.

In all this work manufacturers, distributors and consumers are co-operating with the Department of Commerce "to decrease stocks; production and selling costs, while stimulating turnover, increasing volume and strengthening employment."

The Bureau of Standards, to further the elimination of waste, began in 1923 the preparation of a dictionary, or handbook, of specifications. This book will include the more important specifications in general use, as well as standard Government specifications. It will be arranged "to afford the greatest possible convenience in finding specifications suitable for the material desired."

Another division of the Department, the Division of Building and Housing, has given active aid to the movement sponsoring demonstration houses. These "model houses," as they are more commonly known, have met with marked success in encouraging wiser expenditure for household purposes.

CO-OPERATION WITH TRADE ASSOCIATIONS

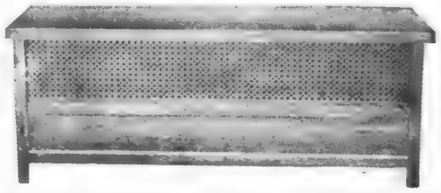
The necessary link to bind business and the Department together was found in the trade associations. There are approximately fifteen hundred trade associations in this country and without exception they welcomed the proffered assistance of the Department. In 1923, it published "Trade Association Activities," a document dealing with the history and aims of trade associations. The publication received popular favor.

For other services of the Department which are more nationally known, such as current business surveys, lists of potential foreign purchasers and research work in such fields as shipping and packing, the heating and ventilating industry has Mr. Hoover to thank for his administration of the Department.

New Apparatus and Appliances

Dixie Radiator Cabinet

A novel type of radiator cabinet which contains a large, artfully-concealed reservoir for humidifying the room air, is the subject of a circular received from the Dixie Metal Products



Dixie Radiator Cabinet with Water Reservoir

Co. Inc., Birmingham, Ala. The cabinets are made to fit any kind of radiator. The water container, which is entirely concealed, extends the full length of the radiator. In this way its capacity varies with the size and capacity of the radiator. The cabinets are made in various styles and designs to suit different styles of radiators and woodwork. They are made of either heavy furniture steel or lighter weight.

New Design of Ozone Pure Airifiers

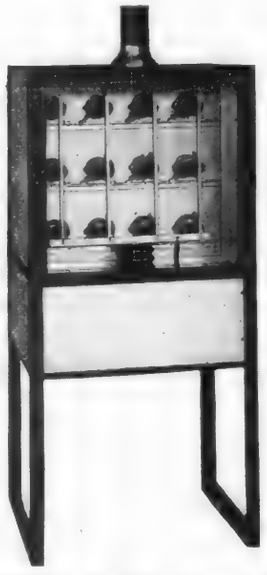
A new design of the Ozone Pure Airifier, of the enclosed type, has been placed on the market by the Ozone Pure Airifier Co., 1455–1457 West Congress St., Chicago, Ill. The new unit

New Ozone Pure Airifier Cabinet, Front View

is shown in the accompanying illustrations. It stands 50 in. high, in a metal-enclosed cabinet. The machine has a small single pipe which leads to the air chamber on the suction side of the fan. The amount of suction already in use draws the supply of ozone into the air chamber where it is mixed with the air.

The meter with which the machine is equipped reads directly in parts of ozone per 1,000,000 parts of air and allows control without computation. A filter is placed over the intake of the machine.

The new unit, which is designed as Enclosed Type E, is listed at about half the cost of the open-frame type equipment. It is built to operate at a higher efficiency. The fact that the machine is arranged to pipe the ozone into the air chamber on the suction side of the fan, it is explained, is the



Rear View of New Ozone Pure Airifier Cabinet

reason why this type can be manufactured at so much lower cost, at the same time effecting the coal savings claimed for the company's previous types of ozone machines.

How this saving is accomplished through the recirculation of air is explained in a circular on the new type, just issued by the manufacturer, which deals also with other advantages of the new construction, such as the small size of the operating unit which permits it to be placed at any convenient location. The generating units, it is stated, require cleaning only once a season. The output is under control and the ozone concentration in the air chamber is shown on a direct-reading meter. The company's descriptive circular contains a sample specification for the use of this machine.

Taco Domestic Water Heater Now Made of Bronze

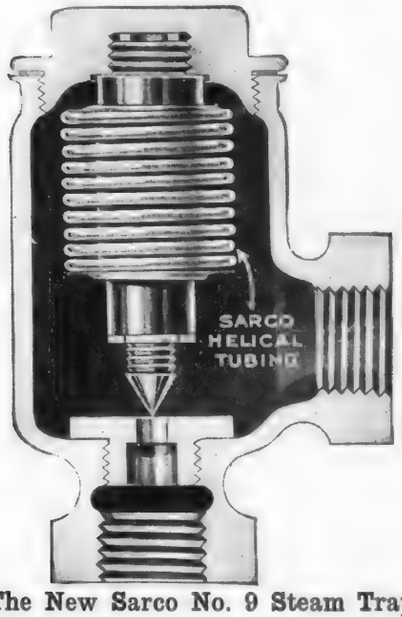
An interesting development in the water heating field is the adoption by the Thermal Appliance Co., 342 Madi-

son Avenue, New York, of bronze in the construction of the Taco water heater. This heater is of the type designed for connection to the house-heating boiler, supplanting the water-back or coil in the fire-pot. It is attached on the outside of the boiler. A 1200-lb. factory test is applied to the appliance to insure its withstanding any city water pressure.

One of the advantages of the bronze construction is that the heater cannot "run rusty." Due to the high conductivity of bronze, the use of this material also adds considerably to the efficiency of the appliance.

A New Steam Trap

To meet the demand for a factory-adjusted steam trap capable of universal use over a range of from 0 to 100 lbs., The Sarco Co., Inc., 231 Broadway, New York, has adapted its special helical tubing to a new use and has brought out a "balanced pressure" steam trap,



The New Sarco No. 9 Steam Trap

which will be known as Sarco No. 9. The new trap, it is stated, combines the advantages of thermostatic operation with independence of pressure variation. Use is made of a seamless tube of heavy bronze deeply corrugated in helical form. The corrugations are designed for extreme flexibility in a longitudinal direction and the helical corrugations are adopted to give an even distribution of the movement and, consequently, an even stressing of the metal. The difference between the movement of a helically-corrugated tube and one made with annular corrugations, it is explained, is somewhat the same as the difference between the movement of an accordion and a spiral spring. Among the advantages mentioned for the helical construction is that of insuring a long life.

In the course of extended experimental work involved in the construction of the new steam trap the Sarco Company has worked out proportions for securing a balancing of pressure between the operating fluid and the steam, in this way permitting the discharge of condensation as quickly from high-pressure steam as from low pressure, despite the wide temperature variations. In action, the higher temperature of high-pressure steam generates a higher pressure within the thermostatic element and this balances against the higher steam pressure in the line, so that the trap actually works on a differential between the pressure and temperature and should be effectively operative at any pressure within its range.

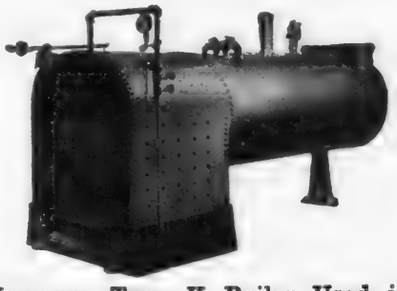
The new steam trap has a large discharge area and high lift, thus providing maximum capacity. It is especially designed for use on steam jacketed cooking vessels, line drips, high-pressure heating coils, laundry equipment, kitchen and hotel fixtures and for use as an automatic high-pressure air vent.

Efficiency Test of a Small-Size Kewanee Fire-box Boiler

The Kewanee Type K boilers were desiged to give the same efficiencies for heating service in smaller buildings as are obtained in the largest sizes. They are made both in smokeless and up-draft types. There are seventeen sizes of the smokeless type and nineteen sizes of the up-draft type, ranging in capacity from 850 sq. ft. to 15,200 sq. ft. of direct cast-iron radiation. The construction conforms to the Kewanee slogan of "steel plus rivets equals strength." It is shipped in one piece ready to be set.

To prove whether these boilers were as efficient as the larger types, several tests were made in the company's laboratory at Kewanee on a 2450 sq. ft. rated capacity up-draft Type K boiler, when operated at various capacities, with damper regulation and long firing periods. The operating characteristics are shown on the accompanying curves.

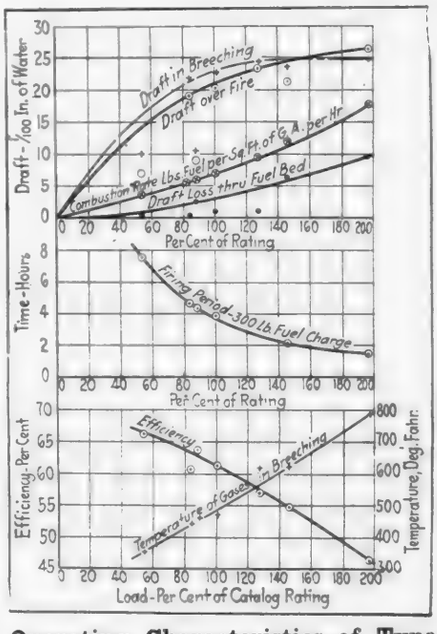
The boiler was a standard No. 8-K, set in accordance with catalog specifi-



Kewanee Type K Boiler Used in Test

cations. The chimney was 18 in. in diameter by 40 ft. in height. The breeching was 20 in. in diameter, approximately 8 ft. in total length, containing one right-angle turn and a damper for draft control. The boiler was equipped with standard Sylphon damper regulator and each test was conducted with the regulator controlling combustion throughout the entire series. Firing was by the "dead plate" method. After the fire burned to an approximate depth of 6 in., the live coals were pushed toward the rear and fresh fuel introduced at the front.

Each test was carried out for nine firing periods. In this manner the total


Draft-1/100 In. of Water
Draft in Breeching
Draft over Fire
Combustion Rate Lbs. Fuel per Sq. Ft. of G. A. per Hr.
Draft Loss thru Fuel Bed
Per Cent of Rating
Time-Hours
Firing Period-300 Lb. Fuel Charge
Per Cent of Rating
Efficiency-Per Cent
Efficiency
Temperature of Gases in Breeching
Temperature, Deg. Fahr.
Load-Per Cent of Catalog Rating

Operating Characteristics of Type K Kewanee Boiler as Indicated by Test

fuel fired was approximately 250 lbs. of coal per square foot of grate. While some of the tests at low capacity were quite long, this was found necessary to keep the error in judging the condition of the fuel bed at start and finish of test within reasonable limits.

The coal used was from the Orient Mine, Franklin County, Illinois, size 6 in. x 3 in. egg. The average analysis was as follows:

Moisture.	4.34%
Volatile matter	37.18%
Fixed carbon	49.24%
Ash.	9.24%
Sulphur.	1.07%

Heat value as fired 12,286 B. T. U.

The moisture in the steam was measured by means of a separator in the steam line. Throughout the range of capacities over which the boiler was tested, the moisture was found uniform and did not increase in amount as the load increased. At no time, the tests showed, did the moisture exceed 2%.

It will be noted that the draft in the firebox (over the fire) is higher than the draft in the breeching. This, it is stated, is due to the fact that the point of measuring the draft in the breeching was approximately 6 ft. above the fire-door, where the draft over the fire was measured. The chimney effect of the 6 ft. of height is apparent in the readings of draft, especially as the draft loss through the boiler is negligible. When the load is approximately 160% of rating, this chimney effect, it will be noticed, is apparently balanced by an equal draft loss through the boiler.

When operated at high capacities, the efficiencies decrease more rapidly, due to the short fire travel. The tubes in this boiler are only 6 ft. long.

Perhaps the point of greatest interest is the performance at 60% of capacity, which is the average for the heating season. At this point, the test shows, the efficiency is 66%, with a firing period of 7 hrs., and with the damper regulator in operation, exactly as the boiler is equipped for handling a heating load.

These tests are offered by the Kewanee Boiler Company as evidence that riveted steel portable firebox boilers in sizes small enough to heat the average-sized building will give dependable and efficient operation.

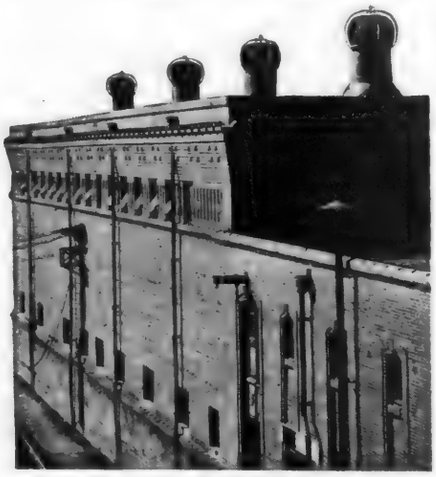
Test of Roof Ventilator Installation in Converter Sub-Station of New York Central Railroad

Authoritative performance data on automatic roof ventilators, so eagerly desired by heating and ventilating engineers, have been obtained in a test of the Allen air-turbine type, a number of which were installed in several of the converter sub-stations of the New York Central Railroad Company. In these installations it was necessary to maintain an even and accurate displacement due to the fact that it was as important to throw off the excessive heat as it was to maintain even temperatures, and at the same time have the equipment entirely storm-proof, since a slight leakage might cause thousands of dollars of damage.

At the request of the New York Central Railroad Company, the manufacturers, the Allen Air-Turbine Ventilator Co., of Detroit, Mich., co-operated with the railroad company's engineering department in testing the efficiency of an installation in the converter substation at 152nd Street and Park Avenue, New York.

According to the figures as given in the accompanying test sheet, the result of the investigation not only substantiated the manufacturer's guaranteed displacements, but showed the ventilators to have greater displacements than those published and guaranteed.

Many large industrial concerns, states the company, have recorded similar test data substantiating the figures obtained in the New York Central test. In addition, the company's engineering staff has made a number of installation efficiency tests which have demonstrated that the Allen air-turbine ventilator construction is equally efficient in lifting and throwing off heavier-than-air bodies like steam, smoke, gases, dust, and fumes as they are in air circulation.



Allen Air-Turbine Ventilators on Roof of New York Central Converter Sub-Station

TEST OF 48-IN. ALLEN AIR-TURBINE VENTILATORS ON SUB-STATION No. 2, N. Y. C. R. R. Co., 152ND ST. AND PARK AVE., NEW YORK.
Oct. 9, 1924, 3:16 P. M., Wind N. W. to S. E.

Anemometer Position	Discharge Velocity, Lineal Feet. (2-Min. Readings)	Turbine Speed Rev. per 2-Min.	Outside Temp. Deg. F.	Inside Temp. Deg. F.	Wind Indicator Readings: Time for 1/10-Mile Dial Records	Elapsed Time Seconds
No. 3						
Center of stack	1472	65	65	88	3:16:5	
18-in. from wall	1405	57	65	88	3:17:3	58
12-in. from wall	1474	65	64	88	3:17:56	53
6-in. from wall	1325	62	64.5	88	3:18:54	58
Center of stack	1363	64	65	88	3:19:50	56
18-in. from wall	1276	67	64.5	88	3:20:55	65
12-in. from wall	1450	67	64	88	3:21:52	57
6-in. from wall	1313	62	64	88	3:23:28	96
					3:24:41	73
No. 4					3:25:40	59
Center of stack	1477	66	65	88	3:26:28	48
18-in. from wall	1345	54	65	88	3:26:57	29
12-in. from wall	1479	64	64	88	3:27:50	53
6-in. from wall	1279	63	64.5	88	3:28:33	43
Center of stack	1441	62	65	88	3:29:3	30
18-in. from wall	1434	65	64.5	88	3:29:42	39
12-in. from wall	1386	65	64	88	3:30:28	46
6-in. from wall	1350	64	64	88	3:31:32	64
					3:32:54	82
					3:34:1	67
					3:35:8	67
					3:36:7	59
					3:37:22	75
					3:38:58	96
					3:39:49	51
					3:40:50	61
					3:41:52	62
					3:43:7	75

Average of readings

Inside Temp. Deg. F.	Outside Temp. Deg. F.	Wind Velocity, Miles per hour.	Discharge Velocity Feet per minute
88	64.5	5.99	694

PERFORMANCE

Ventilator No.	Discharge Velocity Feet per minute	Displacement, Cu. Ft. per min.	Turbine, R.P.M.
3	696	8746	32
4	692	8696	32

Reading Made by

Ventilator No. 3
Anemometer: H. W. Walsh, Eng. Div., N.Y. Central R.R. Co.
R.P.M.: P. B. Kimball, Eng. Div., N.Y. Central R.R. Co.
Ventilator No. 4
Anemometer: L. P. Halleck, Eng. Allen Air-Turbine Ventilator Co.
R.P.M.: B. E. Driscoll, Eng. Div., N.Y. Central R.R. Co.

Thermometers: B. E. Driscoll, Eng. Div., N.Y. Central R.R. Co.

Wind Velocity Indicator: H. J. Van Spanje, Eng. Div., N.Y. Central R.R. Co

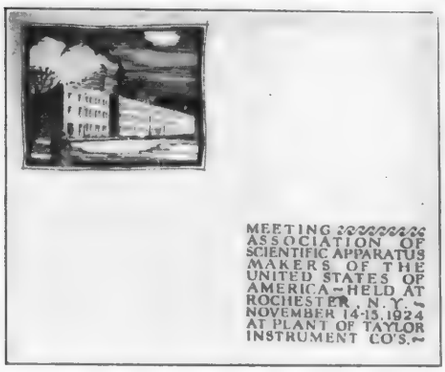
Stop Watch: F. M. Glover, Eng.Div., N.Y. Central R.R. Co.

Instruments Used: Keuffel & Esser Anemometers (100,000-ft. dial with reset).
Henry J. Green Wind-Velocity Indicator and Thermometers.

BULLETIN OF THE NATIONAL DISTRICT HEATING ASSOCIATION for October 15, 1924, is designated as a "Heating Rates Number," being devoted largely to the heating rates now in effect in some 138 cities. Every effort, it is stated, has been made to obtain the latest rate revisions, and the point is brought out that but very few of the companies report any reduction of rates, while a number have increased them. This remarkable compilation will be much appreciated by all interested in central station heating and is typical of the valuable services which trade associations can render.

New Trade Publications

MEETING OF THE ASSOCIATION OF SCIENTIFIC APPARATUS MAKERS OF THE UNITED STATES OF AMERICA is the novel title of an equally novel program of the convention of the Taylor Instrument Company's sales force, in Rochester, N. Y., November 14–15. The welcoming address was made by Vice-President James Ely. He was followed by Presi-



Program Cover of Taylor Instrument Company's Meeting

dent Herbert J. Winn, who gave an outline of the development of the Taylor Instrument Companies. In this connection the program contained some interesting facts regarding the Tycos plant, which covers nine acres and contains 230,000 sq. ft. of factory floor space and 30,000 sq. ft. of office floor space. There are 60 miles of pipe lines for compressed air, steam, refrigeration, gas, fire protection, heat, light, power, water, vacuum system and drainage. A carefully-worked out color scheme has been adopted to distinguish the different pipe lines. Another speaker at the opening session was P. R. Jameson, factory superintendent, who described the factory organization at this plant. At the same session addresses were made by F. K. Taylor, manager of industrial sales; L. B. Swift, M.E., manager sales engineering; H. Y. Norwood, A.B., manager technical department; F. M. Herrick, manager advertising department; H. J. Noble, special accountant; Bradford Noyes, Jr., Ph.D.; H. Brainard Brown, assistant manager technical department and W. F. Johnson, manager of industrial relations. The second day of the convention was devoted to an inspection of the Research Department of the Eastman Kodak Company, followed by a luncheon at the Genesee Valley Club.

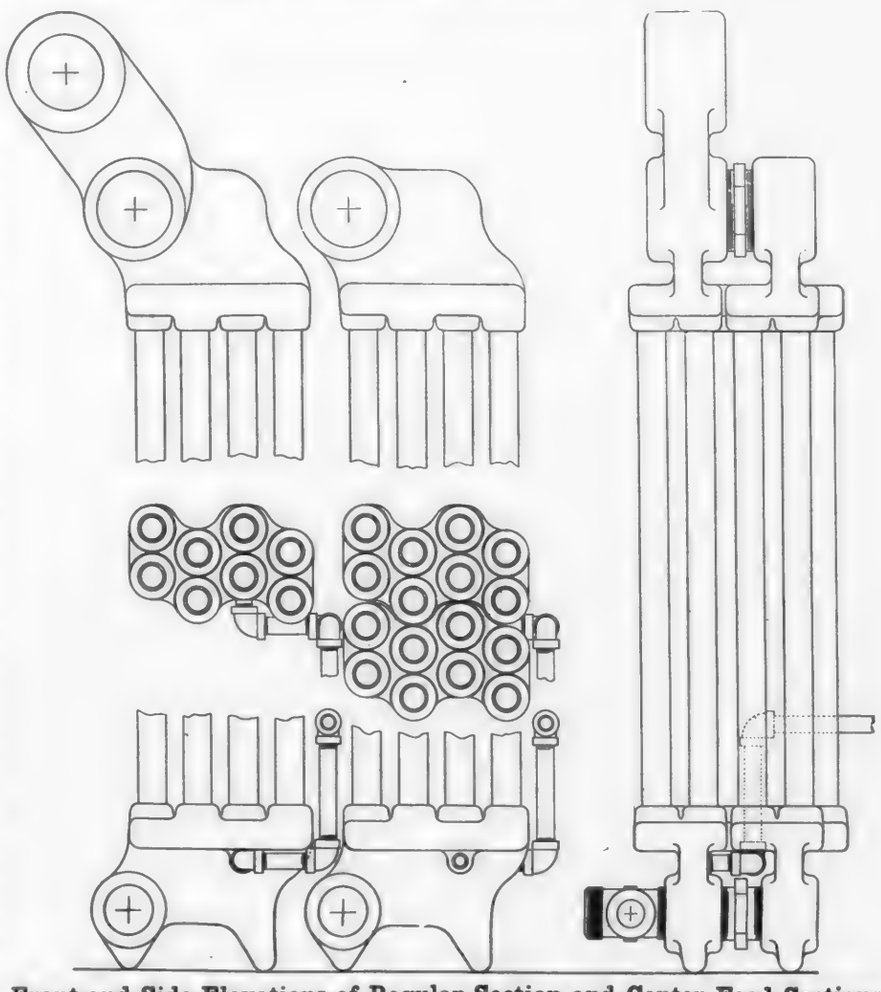
WEATHER STRIPS as a means of eliminating air leakage are discussed in a recent publication of the Monarch Metal Products Co., St. Louis, Mo. Taking "air infiltration" as a basis this company conducted a series of tests to determine the amount of air leakage through window cracks with and without weatherstrips. The rib weatherstrip and the interlocking type were used in the experimental work. The charts that illustrate the booklet are copies of those prepared by the Research Laboratory of the A. S. H. V. E. along the same line. The treatise is a comprehensive work designed to present clearly the variation in air leakage with and without protected windows. Size: 5½ in. x 8½ in. Pp. 54. A manual for architects and engineers is issued in connection with the booklet. Size of latter, 8 in. x 11 in. Pp. 44.

LYON INTERLOCKING HEATERS are presented in a booklet comprised for the most part of complete tables showing final temperatures and weights of condensation under various heating conditions. These data are the results of experimental work done with the idea of presenting accurate information concerning Lyon interlocking heaters. The first few pages deal with description and specifications while the balance of this 64-page booklet is made up of performance tables. Friction of air through the heaters under various conditions, free air sections as compared to heating surfaces, and final temperature and condensation under different air-intake temperatures and center-to-center dimensions are tabulated. The heaters are manufactured by the Lyon Products Co., 312–318 Union Park Court, Chicago, Ill. Size, 9 in. x 12 in. Pp. 64.

VICTOR DAMPER REGULATORS are described in a new bulletin of the Atlas Valve Co., 282 South St., Newark, N. J. The various types of damper regulators are classified under three separate headings: low-pressure or vapor heating, medium-pressure, and high-pressure power-boilers. Hydraulic operation as compared with other methods of operation, the functions of damper regulators and diagrams of installations comprise the balance of the bulletin. It is numbered 5-A, edition No. 1.

ECONOMY BOILER cut-outs for window displays are featured in a 4-page folder of the International Heater Co., Utica, N. Y. The cut-outs are designed as dealer helps for Economy Boiler representatives. The display stands 5 ft. 3½ in. high and is constructed to look like the actual boiler.

HONECO AIRLESS CONTROLLER is the subject of a mailing card received from the American Schaeffer and Budenberg Corp., Brooklyn, N. Y. This appliance is described as a rugged and accurate automatic controller of temperatures and pressures.



Front and Side Elevations of Regular Section and Center Feed Sections of Lyon Interlocking Heater

ECLIPSE STEAM TRAPS of an improved design are introduced in an attractive booklet of the Illinois Engineering Co., Chicago, Ill. The novel feature of the trap lies in the fact that the valve and valve stem are not rigidly attached to the bucket or float and synchronize with the movement of the bucket. The valve is actuated by the bucket but only at the end of travel so that the valve will remain either tightly closed or fully open; never in an intermediate position. The purpose of this is to prevent the valve's cracking on its seat and wire-drawing. The Eclipse combination blast trap, for draining air and water from fan heater, coils, stacks and dry kilns, is also dealt with in the booklet. Illustrations and specifications show in detail the construction and operation of this new mechanism. Size 8½ in. x 11 in.

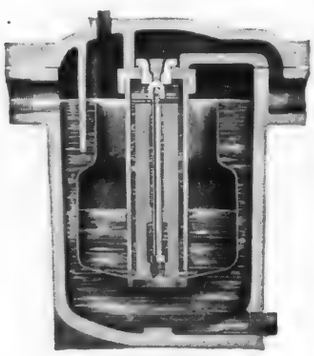


Fig. 1

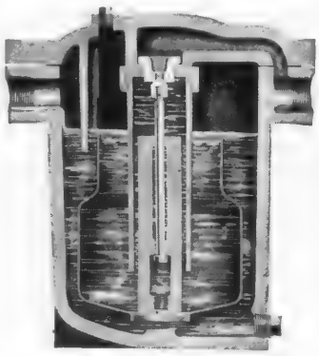


Fig. 2

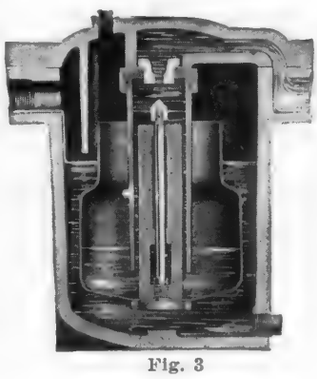


Fig. 3

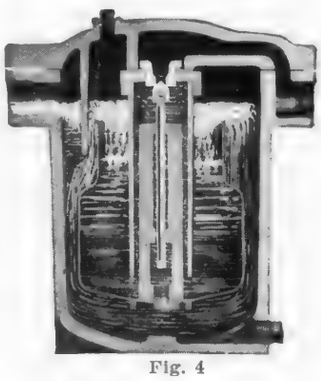


Fig. 4

Positions of Bucket in Eclipse Steam Trap at Four Different Periods of the Cycle

COLUMBIA STRIP CARD RECORDER is described in a 4-page folder of the American Schaeffer and Budenberg Corp., Brooklyn, N. Y. It is intended for applications where it is desirable to obtain a record of temperatures or pressures over an extended period of time and where the cycles of operation are of relatively short duration, requiring a wide, open record for detection and study of slight variations. It is furnished for the recording of steam for all pressures and temperature to 1000° F.

APEX CO_2 RECORDER is introduced to the industry by the Uehling Instrument Co., Paterson, N. J., as a small, inexpensive instrument for smaller plants. For boilers of 50 H.P. or over the manufacturers recommend this instrument as a fuel saver. Save for a pen mechanism it has no moving parts and employs no chemical solutions.

MECHANICAL STOKERS is the subject of a condensed catalog published by the Stoker Manufacturers' Association. The purpose of the book, as set forth by the publishers, is to present "a brief but complete description of all prominent makes of mechanical stokers." The association, composed of twelve large manufacturers of stokers, has its headquarters at foot of Walker Street, Detroit, Mich.

THERMO GAS PILOT IGNITION is introduced in an advance sheet of the Powers Regulator Co., 2720 Greenview Ave., Chicago, Ill. The device has a small enclosed gas-pilot flame which keeps an electric current closed thermostatically and lights a gas ignition flame. This flame lights when the burner starts, ignites an oil spray and goes out again when the burner stops. The mechanism is designed to effect economy of operation. The pilot is covered by Hornung patents of September and October, 1924.

BRASS FACTS is the title of a 26-page booklet published by the Scovill Manufacturing Co., Waterbury, Conn. It deals entirely with the characteristics of copper alloys with particular reference to brass. Brass, of course, is an alloy of copper and zinc. Just how the proportions differ in relation to the application of the finished material is brought out very interestingly in this little publication. Illlustrations showing the microstructure of various brass samples serve to emphasize the important characteristics of brass—particularly for pipe and tubing. Size, 5 in. x 7 in. Pp. 26.

ELLIS BOILER-FEED SYSTEM for draining, heating, drying and cooking apparatus is given publicity in Bulletin No. 41 of the Ellis Drier Co., Roosevelt Road and Talman Ave., Chicago. The catalog, very attractively prepared, describes in detail the function of the system with the aid of an illustration showing a complete installation of boiler and feed apparatus. When the boiler-feed trap is in a filling position, pressure on it is relieved or vented through the line. Condensation from the various heating units is therefore free to enter the trap through the line. When the trap fills with water the valves operate automatically to fill an auxiliary tank which then discharges water into the boiler. In some instances, it is stated, this trap has operated satisfactorily when 500 ft. removed from the auxiliary tank placed over the boiler. The balance of the booklet deals with dimensions and specifications. Size 8½ x 11 in. Pp. 12.

ATHEY WEATHER STRIP is featured in a small folder by its makers, the Athey Co., 6035 West 65th St., Chicago, Ill. The product is of cloth-lined, metal construction of the rib type. The literature describes and illustrates its use and offers examples of installations in various hotels.

RUSSELL U-TUBE STORAGE HEATERS are the subject of a bulletin notable for its completeness, logical arrangement and legibility of its tables, which has just been published by the Griscom-Russell Co., 90 West Street, New York. The tables cover an exceptionally large number of steam pressures, as well as initial and final water temperatures, and include complete details of tank sizes, capacities and dimensions for a wide range of storage capacities. Typical examples of heater and tank selection are worked out for various operating requirements to show the factors that must be taken into consideration to assure satisfactory results.

Besides a complete description, with details of construction and specifications of the Russell U-tube storage heater, the bulletin contains a hitherto

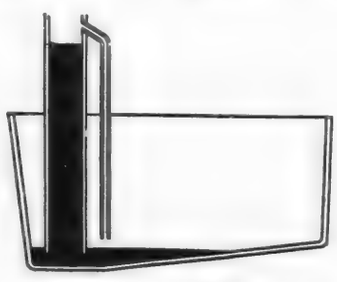


FIG. 2

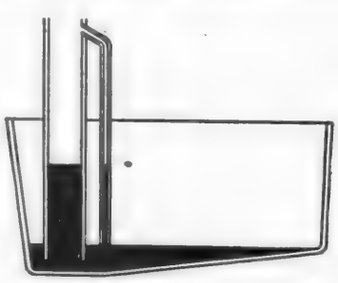
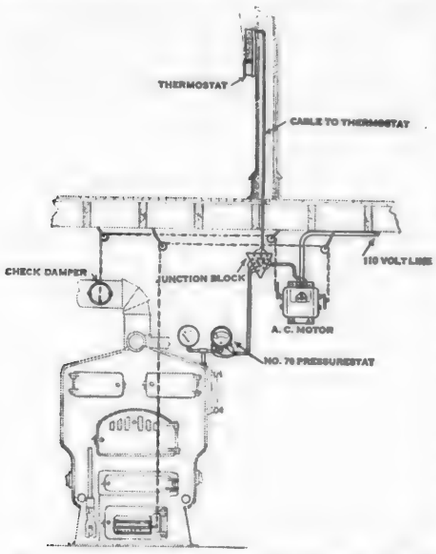


FIG. 1

Action of Air Eliminator in Ellis Red Head Steam Trap

unpublished table of data on hot water requirements for various industrial and domestic uses. An additional feature which will be found helpful in laying out a heating system is a double insert page of templates for storage tanks, drawn to the standard scale of ¼ in. to the foot, covering all standard Russell storage heater tank lengths and diameters, and indicating the principal pipe connections. This can be placed under architects' or engineers' tracings and the template of the heater selected can be traced in the position desired.

MINNEAPOLIS HEAT REGULATORS provide material for an unusual 31-page booklet issued by the Minneapolis Heat



Application of Minneapolis Heat Regulator to Steam or Vapor Boiler

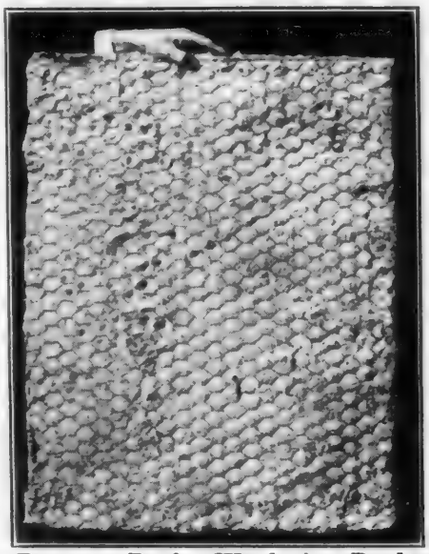
Regulator Co., Minneapolis, Minn. The two regulators featured in the catalog are the new 77 eight-day seven-jewel thermostat and the non-wind electric motor as described in last month's issue. Various applications of the regulators to boilers and furnaces are illustrated with sectional views of typical installations. The manufacturers stress the fact that every part of the regulator is made entirely in their own factory.

THE STORMOGUIDE, the latest addition to the Taylor Instrument Companies' line, Rochester, N. Y., is illustrated in an attractive eight-page announcement lately received. The Stormoguide, designed primarily for "golfers and all outdoor peoples," is a carefully-constructed barometer mounted on a mahogany stand, the assembly giving the appearance of a mantel clock. The graduations on the dial are interpreted in detail on the face and an idle hand makes it possible to determine if the atmospheric pressure is rising or falling. Two types are being marketed, one as described and a less expensive model with a round brass case.

UNIVERSAL UNIT VENTILATING SYSTEM, featuring the Universal unit ventilator with improved cast-iron radiator, is presented in Bulletin No. 202, issued by John J. Nesbitt, Inc., Atlantic City, N. J. This unit supplements that recently placed on the market by this company in which the heating surface is a Cartridge copper radiator, and has been developed to meet the demand of those who prefer the cast-iron surface. The new cast-iron radiator is made with a cored interior. The extensions are parallel with the downward air flow, so as to keep down to a minimum the resistance to the air flow. The steam inlet is at the top, this arrangement being made to allow the coldest air to come into contact with the hottest surface. What the company describes as the salient feature of this new radiator is the series of air passages in the center of the sections. These passages allow the air to expand laterally through the length of the radiator and help to equalize the load on all sections. The sections are joined by hexagonal, external nipples and the top section of the radiator is inclined backwards to allow for full operation of the temperature-control damper. As in the other types of the company's unit ventilators, all of the air can be excluded from the heating chamber or it may be by-passed around this chamber. Intermediate settings may be obtained by the damper control. These units are made in four sizes with capacities of from 36,000 to 90,000 cu. ft. of air per hour. The bulletin contains full data regarding each size, including roughing-in dimensions, tapping schedules and sample specification. Size 8 x 11 in. Pp. 8.

BANNER ROCK WOOL JACKET, an insulation for high temperatures, is presented in a booklet (Bulletin No. 14) prepared by the Banner Rock Products Co., Alexandria, Ind. The insulating wool, suitable for oil stills, metallurgical furnaces, tanks and boilers, is treated in this publication with respect to its specifications, applications and efficiency in industrial work. The jacket itself is made up of rock wool placed

Banner Rock Wool in Expanded Metal Covering, Partly Plaster Finished



Banner Rock Wool in Poultry Netting Fabric

between two walls of poultry-netting with painted, expanded metal placed over the netting on one side. The stock size is 3 ft. x 8 ft.

WEBSTER SERVICE DETAILS, issued by Warren Webster & Co., Camden, N. J., comprising some 168 sheets, have recently been supplemented by 14 new and revised sheets. Of these one shows a typical layout of a Webster Type R modulation system using the Webster boiler-return trap for returning condensation to the boiler. Another is a revision of a former sheet, showing the addition of a Webster dirt strainer and the approved method of installing the wet-return line by connecting it into the discharge of the boiler-return trap beyond the check valve. A sheet has been included showing the arrangement of piping around the new No. 0023 boiler-return trap. This smaller-size unit is intended for use in residences and other installations containing not over 1500 sq. ft. of equivalent cast-iron direct radiation. Then there is a sheet showing the correct relation between boiler-return trap and dry return from a portion of the basement where the ceiling is at a lower level. It is also useful where the dry-return mains are long and the head-room is restricted so that it is necessary to relay the return instead of running it in a straight line. Two of the new sheets illustrate the application of the double-service valve in which the steam supply is controlled automatically instead of by hand. A sheet giving the dimensions of the new No. 3 duplex vent trap is included, this trap being for use in connection with two boiler-return traps for installations containing from 16,000 to 32,000 sq. ft. of equivalent direct cast-iron radiation. There is also a detail showing the method of piping up the No. 3 duplex vent trap with two No. 323 Webster boiler-return traps. All of the sheets are printed in uniform size and punched for loose-leaf binding, a suitable binder, with index, being furnished by the company.

(*Heating and Ventilating Magazine, December*, 1924)

How To Heat Your Home

(This is the third of a series of articles giving practical information on fuels and furnaces.)

III How to Use Anthracite

By Samuel S. Wyer

Associate in Mineral Technology, U. S. Smithsonian Institution.
(*Science Service*)

THE public has been erroneously taught to believe that only so-called "domestic sizes" of anthracite could be used in the home. The small "steam sizes" represent 29% of the total anthracite mined. As the public, through lack of understanding of the facts, has been unwilling to use these they become mere by-products and are sold below cost of production at whatever they will bring and are used in competition with bituminous coal without regard to their intrinsic value. For instance, when the f.o.b. mine price on "stove size" was $8.10 the "steam size" brought as low as $1.50 per ton. The loss on the "steam sizes" must be made up on the "domestic sizes." Yet with proper utilization methods these steam sizes can be successfully used in the home.

Trade customs and improper utilization methods have resulted in an unnecessary number of sizes. These all add to the ultimate cost. From the public's viewpoint it would be desirable to arrange for an immediate reclassification and the adaptation of domestic appliances to the use of the smaller sizes, that, under existing market conditions, are sold in competition with bituminous coal.

To burn any small anthracite, it is necessary to provide forced draft at the rate of about 235 cu. ft. of air per pound of coal burned. The size of motor required rarely exceeds 1/6 H.P. and requires about 8 K.W.H. of electric energy per net ton of coal burned.

A cast-iron plate, with about 10% of its area in holes, about 1/2 in. in diameter, is laid on top of the old grate and cemented tight around the edges of the furnace so that all the draft must pass through the holes.

Fires are cleaned entirely by hooking clinkers out of the firing door. Only a very small amount of dust finds its way through the small holes in the plate into the ash-pit, and it is rarely necessary to clean an ash-pit more than twice during the entire heating season. The stack damper must be entirely removed or fastened in its open position to prevent closing. In firing and in banking, it is very important that at least one bright spot be left uncovered in order that the gases, as they are driven off the fuel bed will be ignited. In banking the fire, it is only necessary to stop the blower. The system lends itself well to thermostat regulation, the thermostat being employed to stop and start the motor instead of opening and closing the dampers.

Follow the following rules in burning the ordinary domestic sizes of anthracite:

1. Carry a deep fuel bed, 5 to 10 in. thick, so that it will not burn through in spots and admit large excess of air.
2. Shake the grate to remove ashes, but stop before live coals appear in the ashes.
3. Fresh fuel should be spread evenly over the entire grate area.
4. Be sure to leave one visible bright spot of live coal to ignite the gases coming off the freshly-fired fuel. In this way the gases from the coal will be burned gradually and will not accumulate in the fire pot and burn with an explosion.
5. After firing, keep the dampers wide open until blue flame appears, then check off the draft as much as necessary to keep fire burning at desired rate.

When burning coke with pea or buckwheat anthracite follow rule 5 above and:

1. Spread a thin layer of anthracite over the entire grate and allow a few minutes for this fuel to ignite. Next fill the fire pot with coke and allow this to burn until blue flame appears, then add another layer of anthracite.
2. When banking the fire use less coke and more anthracite but otherwise fire in the same manner.

(*Next month*: *How To Burn Bituminous Coal.*)

Meeting of German Heating and Ventilating Engineers in Berlin

A report of what is described as the eleventh meeting of the Society of Heating and Ventilating Engineers of Germany (Elfter Kongress fur Heizung und Luftung) held recently in Berlin, has been received from the headquarters of the society at Linkstrasse 29, Berlin W. 9, George Dieterich, director.

Nearly 1500 members and guests were registered at the meeting which, writes Mr. Dieterich, may be regarded as an indication that the heating and ventilating industry of Germany is gradually getting back into its ordinary course.

The meeting opened under the presidency of Professor Hartmann of Gottingen with addresses by representatives of the government and by representatives of the technical science and industry.

Five sessions were held in which there were presented many reports devoted to timely topics and encouraging discussion. The rank which the heating and ventilating industry is occupying with respect to the common welfare of the nation was reported by Manager-General Dieterich (Verband der Centralheizungs-Industrie). An interesting address, delivered by Professor Knoblauch of Munich, discussed the usefulness of scientific thinking in heating matters. The amount of heat to be provided in given buildings was brought up and details were given on the heating of small cottages from the standpoint of the architect.

The question of how to utilize the exhaust steam for the purpose of central station heating was broadly treated in a report by Professor Eberle, of Darmstadt. Gas heating and electric heating were also subjects for discussion and data were presented on the properties and character of the various fuels used in Germany.

The problem of ventilation brought out a lively series of talks and reports on secondary topics of the heating industry contained a mass of interesting data.

The meeting was brought to a close with an address by President Huber, of Munich, and some of the visiting guests.

The Antioch Business Code

A unique educational method which is known as the "Antioch Business Code," is being followed at Antioch College, Yellow Springs, Ohio. Antioch College combines in a single coordinated course, a liberal college education, vocational training, and actual experience in practical life. The students spend half time at college and half time at practical work, in alternate periods of five weeks. Training for business administration is one of the chief vocational aims of the college, and much of the part-time work is training for that field. The course is six years long.

Deaths

Robert Wuest, commissioner of the National Metal Trades Association from 1903 to 1913, died at Atlantic City. He was in his sixty-first year.

HARVEY E. HERSH, a member of the firm of Hersh Bros. Co., Allentown, Pa., manufacturer of the Lehigh line of fans, blowers, air washers, etc., died November 9, after a brief illness. He was 54 years old. Mr. Hersh's entire career was intimately identified with the heating and ventilating industry and his inventive mind produced many useful ideas which have furthered the art, especially in connection with sheet-metal work.

.:!:.

PARTIAL LIST OF USERS OF POWERS CONTROL

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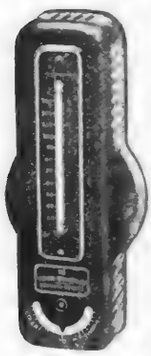
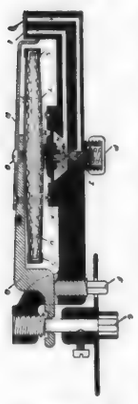
POWERS CONTROL IS LOWEST IN COST-PER-YEAR



The brains of a system of temperature control are its Thermostats. Radiator Valves, Damper Motors, Air Compressors and Piping merely help to carry out the commands of Thermostats. These parts may be of good quality and carefully installed, yet if the Thermostats, which control and operate them, frequently get out of adjustment, earnings on the money invested in the apparatus are reduced by *waste of fuel* and *"service" bills.*

Powers VAPOR DISC Thermostats *need no annual adjustment.* Extremes of temperature in summer, and the occasional chill of unheated rooms in winter develop no error in their adjustment.



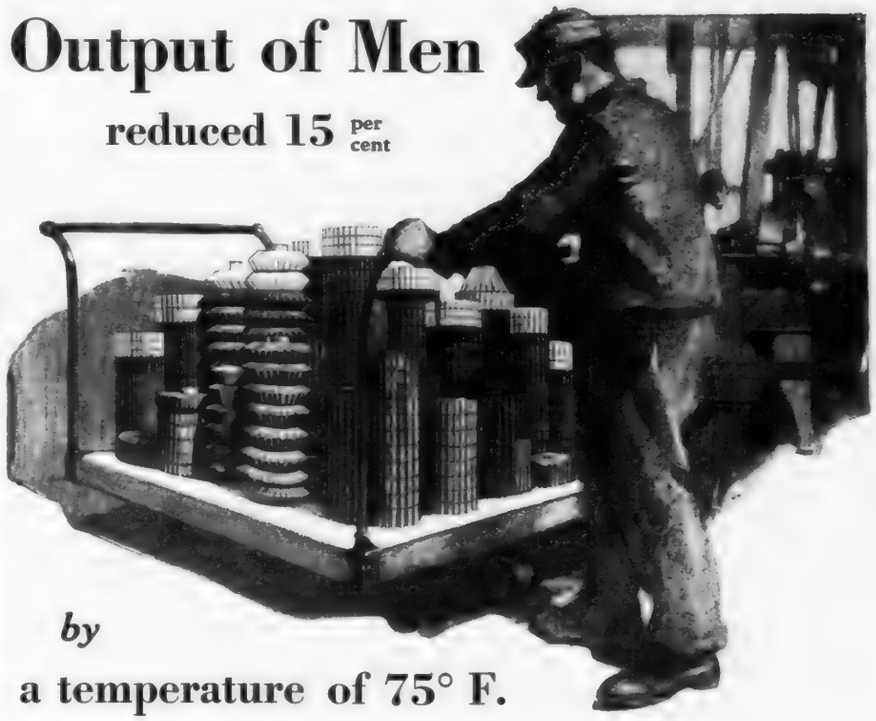
Powers K Thermostat and cross section of operating mechanism

Write for this book

Our book "The Elimination of Heat Waste" shows why Powers Thermostats give such accurate and DEPENDABLE control, often without repairs of any kind for 10 to 15 years. May we send you a copy?

Output of Men

reduced 15 per cent



by

a temperature of 75° F.

Says N. Y. State Commission on Ventilation

BY examining some of the evidence recently brought to light on the harmful effect which overheating has on the output of men, Heating and Ventilating Engineers may be able to save their clients many thousands of dollars.

In workshops, where employees are stirring around actively, it is generally agreed that the air should always be kept at a uniform temperature lower than 68° F.

Most Workrooms Are Overheated

The New York State Commission on Ventilation, in its thorough investigation carried on in industrial plants of New York State, found that in the work-rooms under observation, 71 per cent were at a temperature over 72° F. and 29 per cent were at a temperature over 79° F.

This is not surprising when you consider that heating systems are designed to heat buildings properly during severely cold weather. About 5 to 10 per cent of each heating season is "severely cold" so that during the remaining 90 per cent, overheating is common.

Effect of Overheating on Output of Men

On this subject, the N. Y. State Com. on Ventilation states in its report: "We have demonstrated a very marked and significant influence of atmospheric temperature upon the performance of physical work. *An increase of room temperature from 68° F. to 75° F. caused a decrease of 15 per cent in the physical work performed by men who were not compelled to maximum effort but were stimulated by a cash bonus.*"

The Commission also states that a rise in temperature to 86° F., under the same conditions, resulted in a decrease of 28 per cent in output.

Get this for your files

Other important facts which clearly show the necessity of providing adequate, ACCURATE and DEPENDABLE temperature control in workrooms will be found briefly stated in Vol. , No. 2, of our magazine, "The Thermostat."

Upon request we shall be glad to send you a copy for your files, without cost or obligation.

THE POWERS REGULATOR COMPANY

33 years of specialization in automatic temperature control

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(112)

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. C.

RADIATOR RATINGS

One-Inch Pipe Coil, Exposed

1" PIPE COIL-EXPOSED RATING

ACTUAL SURFACE is the area of pipe surface per foot length of the coil selected

EQUIVALENT SURFACE is the equivalent number of standard sq. ft. of radiation at 150 btu per sq. ft.

PIPES HIGH	PIPES WIDE / INCHES HIGH	2		3		4		5		6		7		8		9	
	INCHES WIDE	4"		6½"		9"		11½"		14"		16½"		19"		21½"	
		Actual Surface	Equivalent Surface	Actual Surface	Equivalent Surface	Actual Surface	Equivalent Surface	Actual Surface	Equivalent Surface	Actual Surface	Equivalent Surface	Actual Surface	Equivalent Surface	Actual Surface	Equivalent Surface	Actual Surface	Equivalent Surface
6	13 3/8"	4.1	6.0	6.2	8.2	8.3	10.2	10.4	12.2	12.5	14.1	14.5	15.6	16.6	17.5	18.8	19.1
7	15 3/4"	4.9	6.8	7.3	9.3	9.7	11.5	12.1	13.8	14.5	15.8	17.0	17.7	19.4	19.8	21.8	21.6
8	18 1/8"	5.5	7.6	8.3	10.3	11.1	12.8	13.8	15.2	15.6	17.7	19.4	19.7	22.2	22.1	25.0	24.1
9	20½"	6.2	8.4	9.4	11.4	12.5	14.1	15.6	16.7	18.8	19.5	21.8	21.7	25.0	24.2	28.0	26.4
10	22 7/8"	6.9	9.1	10.4	12.4	13.8	15.3	17.3	18.2	20.8	21.0	24.2	23.6	27.6	26.3	31.2	28.7
11	25¼"	7.6	9.9	11.4	13.3	15.2	16.5	19.1	19.8	22.8	22.6	26.6	25.5	30.4	28.4	34.3	31.0
12	27 5/8"	8.3	10.6	12.5	14.3	16.6	17.6	20.8	21.2	24.8	24.3	29.0	27.4	33.2	30.4	37.4	33.2
13	30"	9.0	11.3	13.5	15.2	18.0	18.8	22.5	22.5	26.9	25.7	31.5	29.0	36.0	32.2	40.5	35.4
14	32 3/8"	9.7	12.0	14.5	16.1	19.4	20.0	24.2	23.8	29.0	27.2	34.0	30.6	38.8	34.1	43.6	37.5
15	34¾"	10.4	12.7	15.6	17.1	20.8	21.2	26.0	25.1	31.0	28.8	36.4	32.3	41.5	36.0	46.7	39.6
16	37 1/8"	11.1	13.4	16.6	18.0	22.2	22.4	27.6	26.4	33.1	30.3	38.8	34.1	43.3	37.9	49.8	41.6
17	39½"	11.7	14.0	17.6	18.8	23.4	23.4	29.4	27.7	35.2	31.9	41.2	35.9	47.1	39.8	52.9	43.6
18	41 7/8"	12.5	14.6	18.6	19.6	25.0	24.5	31.2	29.0	37.3	33.4	43.6	37.6	49.8	41.6	56.0	45.7
19	44¼"	13.2	15.2	19.7	20.4	26.2	25.5	32.9	30.2	39.3	34.9	46.0	39.0	52.5	43.5	59.1	47.8
20	46 5/8"	13.9	15.9	20.8	21.2	27.6	26.5	34.6	31.5	41.4	36.4	48.5	40.5	55.3	45.4	62.2	49.9

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Radiator Ratings—1-in. Pipe Coil, Exposed — No. 14-T

Copies of this Data Sheet, printed separately, 5 cents each.

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. C.

RADIATOR RATINGS

1¼-Inch Pipe Coil, Exposed

1¼" PIPE COIL—EXPOSED RATING

ACTUAL SURFACE is the area of pipe surface per foot length of the coil selected

EQUIVALENT SURFACE is the equivalent number of standard sq. ft. of radiation at 250 b.t.u. per sq. ft.

PIPES WIDE	INCHES WIDE	2		3		4		5		6		7		8	
PIPES HIGH	INCHES HIGH	4½"		7½"		10½"		13½"		16½"		19½"		22½"	
		Actual Surface	Equivalent Surface	Actual Surface	Equivalent Surface	Actual Surface	Equivalent Surface	Actual Surface	Equivalent Surface	Actual Surface	Equivalent Surface	Actual Surface	Equivalent Surface	Actual Surface	Equivalent Surface
4	10½"	3.5	5.3	5.2	7.0	6.9	8.7	8.7	10.3	10.4	11.8	12.2	13.4	13.9	14.7
5	13½"	4.3	6.2	6.5	8.3	8.7	10.3	10.9	12.4	13.0	14.0	15.2	15.8	17.4	17.6
6	16½"	5.2	7.1	7.8	9.6	10.4	11.9	13.0	14.2	15.6	16.3	18.2	18.2	20.8	20.1
7	19½"	6.1	8.1	9.1	10.8	12.2	13.5	15.2	16.0	18.2	18.3	21.3	20.6	24.4	22.8
8	22½"	6.9	9.0	10.4	12.0	13.9	15.0	17.4	17.8	20.8	20.2	24.4	22.8	27.8	25.3
9	25½"	7.8	9.9	11.7	13.5	15.6	16.4	19.5	19.4	23.4	22.2	27.4	24.9	31.2	27.5
10	28½"	8.7	10.8	13.0	14.3	17.4	17.8	21.7	21.1	26.0	24.1	30.4	27.0	34.8	30.0
11	31½"	9.6	11.7	14.3	15.5	19.1	19.2	23.9	22.8	28.6	26.0	33.4	29.0	38.2	32.5
12	34½"	10.4	12.4	15.6	16.6	20.8	20.5	26.0	24.2	31.2	27.9	36.4	31.4	41.6	34.7
13	37½"	11.3	13.3	16.9	17.7	22.6	22.0	28.2	26.0	33.8	29.8	39.5	33.4	45.2	37.3
14	40½"	12.2	14.1	18.2	18.7	24.3	23.3	30.4	27.9	36.4	31.6	42.6	35.4	48.6	39.4
15	43½"	13.0	14.8	19.5	19.8	26.0	24.4	32.6	29.4	38.0	33.4	45.6	37.4	52.2	41.7
16	46½"	13.9	15.7	20.8	20.9	27.8	25.7	34.7	31.1	41.6	35.0	48.6	39.3	55.6	43.8

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Radiator Ratings—1¼-in. Pipe Coil, Exposed — No. 14-U

Copies of this Data Sheet, printed separately, 5 cents each.

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. C.

RADIATOR RATINGS

1½-Inch Pipe Coil, Exposed

1½" PIPE COIL—EXPOSED RATING

ACTUAL SURFACE is the area of pipe surface per foot length of the coil selected

EQUIVALENT SURFACE is the equivalent number of standard sq. ft. of radiation at 250 bto. per sq. ft.

PIPES HIGH	PIPES WIDE — INCHES WIDE	2		3		4		5		6		7	
	INCHES HIGH	5½"		9"		12½"		16"		19½"		23"	
		Actual Surface	Equivalent Surface	Actual Surface	Equivalent Surface	Actual Surface	Equivalent Surface	Actual Surface	Equivalent Surface	Actual Surface	Equivalent Surface	Actual Surface	Equivalent Surface
4	12½"	3.9	5.5	5.9	7.3	7.9	9.1	9.9	10.9	11.9	12.6	13.8	14.0
5	16"	4.9	6.5	7.4	8.8	9.9	11.0	12.3	12.9	14.8	15.0	17.3	16.8
6	19½"	5.9	7.5	8.9	10.2	11.9	12.7	14.8	14.9	17.8	17.2	20.8	19.4
7	23	6.9	8.5	10.4	11.5	13.8	14.3	17.3	16.9	20.8	19.4	24.2	21.9
8	26½"	7.9	9.5	11.9	12.8	15.8	15.9	19.8	18.8	23.7	21.6	27.6	24.4
9	30"	8.9	10.4	13.3	14.0	17.8	17.4	22.2	20.6	26.7	23.6	31.1	26.8
10	33½"	9.9	11.4	14.8	15.2	19.8	19.0	24.7	22.3	29.6	25.8	34.6	29.1
11	37"	10.9	12.3	16.3	16.4	21.8	20.4	27.2	24.2	32.6	27.8	38.1	31.3
12	40½"	11.8	13.1	17.8	17.6	23.7	21.9	29.6	26.0	35.6	29.8	41.6	33.5
13	44"	12.8	14.0	19.3	18.8	25.7	23.3	32.1	27.6	38.6	31.8	44.9	35.6
14	47½"	13.8	14.8	20.8	20.0	27.7	24.7	34.6	29.0	41.6	33.8	48.4	37.9

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Radiator Ratings—1½-in. Pipe Coil, Exposed — No. 14-V

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THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. C.

RADIATOR RATINGS

Two-Inch Pipe Coil, Exposed

2" PIPE COIL—EXPOSED RATING

ACTUAL SURFACE is the area of pipe surface per foot length of the coil selected
EQUIVALENT SURFACE is the equivalent number of standard sq. ft. of radiation at 250 b.t.u. per sq. ft.

PIPES HIGH ↓	PIPES WIDE → / INCHES WIDE / INCHES HIGH	2 — 7"		3 — 11½"		4 — 16"		5 — 20½"		6 — 25"		7 — 29½"	
		Actual Surface	Equivalent Surface	Actual Surface	Equivalent Surface	Actual Surface	Equivalent Surface	Actual Surface	Equivalent Surface	Actual Surface	Equivalent Surface	Actual Surface	Equivalent Surface
3	1½"	3.7	5.0	5.6	6.7	7.5	8.3	9.3	9.9	11.2	11.3	13.1	12.7
4	16"	5.0	6.7	7.5	8.4	10.0	10.5	12.4	12.4	14.9	14.2	17.4	16.0
5	20½"	6.2	7.4	9.3	10.0	12.4	12.5	15.6	14.5	18.7	16.9	21.8	19.0
6	25"	7.5	8.6	11.2	11.6	14.9	14.4	18.7	17.0	22.4	19.5	26.1	21.9
7	29½"	8.7	9.7	13.1	13.2	17.4	16.3	21.8	19.1	26.1	22.2	30.5	24.9
8	34"	10.0	10.8	14.9	14.5	19.9	18.1	24.9	21.2	29.9	24.6	34.8	27.8
9	38½"	11.2	11.9	16.8	15.9	22.4	19.7	28.0	23.3	33.6	26.9	39.2	30.6
10	43"	12.4	13.0	18.7	17.3	24.9	21.4	31.1	25.4	37.3	29.2	43.5	33.1
11	47½"	13.7	14.0	20.5	18.6	27.4	23.1	34.2	27.4	41.1	31.6	47.9	35.6
12	52"	14.9	14.9	22.4	20.0	29.9	24.8	37.3	29.4	44.8	33.9	52.3	38.3
13	56½"	16.2	15.8	24.3	21.4	32.3	26.6	40.4	31.4	48.5	36.3	56.6	40.7

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Radiator Ratings—2-in. Pipe Coil, Exposed — No. 14-W

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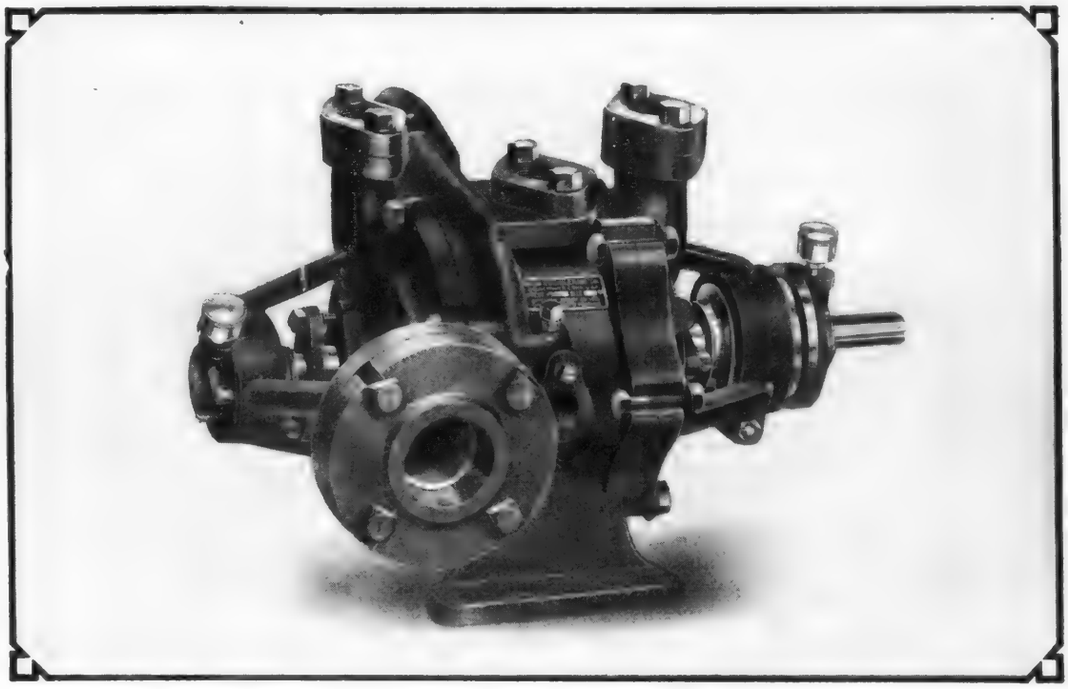


Jennings Hytor Vacuum Heating Pump, Size C; suitable for 26,000 square ft. radiation. Only 2 hp. motor, 1800 r.p.m. is required when delivering from a vacuum of 10 in. of mercury against a boiler pressure of 10 lbs.

The importance of the Vacuum Heating Pump

The function of the return line vacuum pump is three-fold: to remove the water condensation, air and other non-condensible gases from the heating system, to reduce the pressure in the return main and thereby promote the circulation, and thirdly, to return the water to the hot-well or boiler, and dispose of the air and gases.

To accomplish the desired results efficiently is not easy. Any vacuum pump will not do it. Even many so-called heating pumps deteriorate rapidly in service, largely because grit is always present in the condensation.

Heating engineers, contractors and others who are responsible for the selection, installation and operation of heating pump equipment know this full well. No wonder, then, that an ever-increasing number are standardizing on Jennings Hytor Return Line Vacuum pumps exclusively. For Jennings Hytors are designed, constructed, inspected, tested and guaranteed for the work for which they are recommended.

The hundreds of installations throughout the country in which Jennings Hytors have given unfailing performance for years and years prove conclusively that they can always be depended on to obtain the best results out of the heating system.

You should have a complete file of our heating pump bulletins. Available on request.

NASH ENGINEERING COMPANY

South Norwalk **Connecticut**

Jennings Hytor

RETURN LINE AND AIR LINE VACUUM PUMPS CONDENSATION AND CIRCULATING PUMPS

Trade and Miscellaneous Notes

Miscellaneous Notes

American Association of Oil Burner Manufacturers has moved its headquarters from Galesburg, Ill., to New York City. The location is Room 1408 at 350 Madison Ave. The Chicago office, 20 East Jackson Boulevard, will continue to serve members in Chicago and vicinity.

J. E. Bolling has opened an office as a consulting engineer at 1044 Catalpa Ave., Chicago, Ill. Mr. Bolling was formerly editor of the *Weather Vein*, the periodical of the Carrier Engineering Corporation, Newark, N. J.

Construction activity increased very considerably in October, according to F. W. Dodge Corporation's monthly statement. Contracts awarded last month in the 36 Eastern States (which include about seven-eighths of the total construction volume of the country) amounted to $410,090,000. The increase over September was 19%; over October of last year, 14%. The high record is a good indication that building activity will continue into the winter months at a satisfactory rate.

Architectural and Allied Arts Exposition will be held in Grand Central Palace, New York City, from April 20 to May 2, under the auspices of the American Institute of Architects.

Eighth Annual Industrial Conference of the New York State Department of Labor was held in New York City, December 2, 3 and 4. Morning and afternoon sessions were held in the ballroom of the Hotel Roosevelt, Madison Ave., at 45th and 46th Sts. The broad general theme of the conference was "The Maintenance of Peace and Stability in Industry."

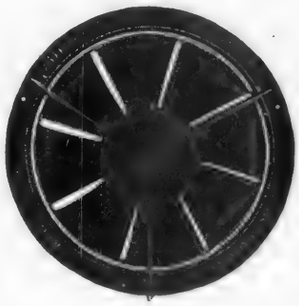
J. C. Hobbs, a former president of the National District Heating Association and for many years superintendent of heating of the Duquesne Light Company and the Allegheny County Steam Heating Company, of Pittsburgh, has resigned to accept a position with the Diamond Alkali Company, of Painesville, O. Mr. Hobbs has already moved his family to his new location. While no longer directly connected with the central heating field, he will no doubt maintain his interest in the work of the National District Heating Association and in the field it represents.

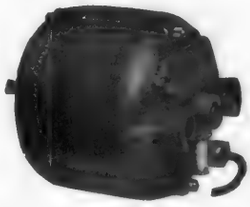
New York Steam Corporation, New York, through the connection of its steam distribution system with the power stations of the New York Edison Company, will shortly be in a position to serve the Forty-second Street district, including Times Square and the Grand Central Terminal sections.

Cost of Living figures compiled by the National Industrial Conference Board show the purchasing value of the dollar to be 60.6 cents in October, compared with $1.00 in July, 1914. Some increase in the major items comprising the family budget are shown between September 15 and October 15 and are largely due to seasonal influences. The increases are approximately 1% for food, 1% for fuel and 2% for clothing. The increase in the cost of living since July, 1914, is 65%, but this figure shows a decrease of 19.3% from the high peak which was reached in July of 1920.

Michigan State Administration Board has advanced the management of the Roosevelt American Legion Hospital at Battle Creek, Mich., $35,000 to install a new heating plant and to meet other expenses. The plant, it is estimated, will cost $22,000.

AUTOVENT ACID-MOISTURE PROOF FANS





Here is a fan that can be relied upon to operate efficiently under air conditions that prohibit the use of standard types of fans.

Autovent Acid-Moisture Proof Fans are especially designed for installations where extraordinarily unfavorable conditions prevail and are equipped with fully enclosed motors. The inspection covers are provided with gaskets and tight fitting joints, with motor leads projecting through frame of motor by means of threaded tapered bushings with gaskets.

Complete specifications are given in bulletin No. 63—yours for the asking.

AUTOVENT FAN & BLOWER CO.

DEPT. "H"

730-738 W. Monroe St. - - - CHICAGO

OFFICES IN PRINCIPAL CITIES

Manufacturers' Notes

Gartland Haswell Rentschler Foundry Co., Dayton, O., are now manufacturing the Bernhard triple combustion boiler. J. B. Bernhard is sales manager.

H. B. Smith Co., Westfield, Mass., has taken title to property on Gray's Ferry Ave., Philadelphia, Pa. The new addition cost $40,000.

American Carbonic Machinery Co., Wisconsin Rapids, Mich., has opened a New York office at 30 Church St., Room 2200. H. E. Fisher is in charge.

EverHot Heater Company, Detroit, Mich., has moved into its new plant at 5241 Wesson Ave., in that city.

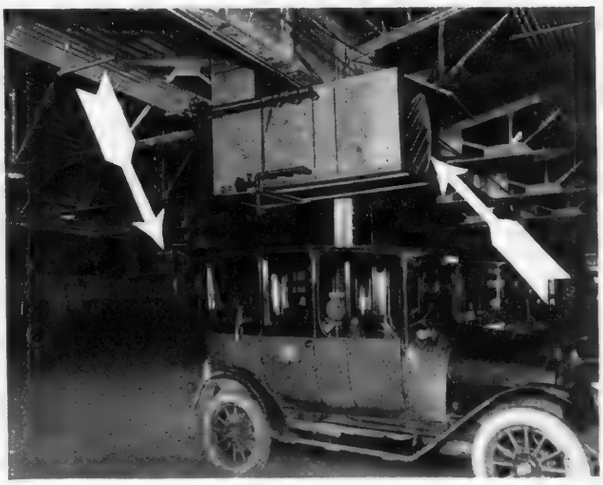
American Radiator Co., New York, announces a stock dividend of 50%, payable December 31 to stockholders of record of December 15. The present quarterly dividend rate of $1.00 per share on the common stock will be continued, following the payment of the stock dividend, it was stated. In a statement issued by C. M. Woolley, chairman of the board, he said that "during the 32 years of the company's existence the opportunity for developing this industry throughout the world has been so favorable that the directors have been able to devote the larger part of profits to the fostering of company growth. Such constructive application of profits has made it possible from time to time to requite the shareholders for their devotion to company progress by the payment of stock dividends, which policy has served to maintain a very conservative relationship of capitalization to assets. In 1892 the company had about 500 employes. It now employs throughout its many plants 20,000 persons."

W. D. Cashin Co., 35 Hartford St., Boston, Mass., announces a complete line of vacuum and vapor heating specialties of the company's own manufacture, consisting of Graduate inlet valves, Thermoflex radiator traps, blast traps, vent traps and alternator return traps. The specialties, states the company, are the result of many years' experience in handling vacuum and vapor heating equipment.

General Boilers Co., Waukegan, Ill., manufacturer of the Pacific line of steel heating boilers, announces the

The Garage Owner Is Interested in More Heat For Less Money

Built for placing on the floor or suspended from the ceiling. Furnished with Vento or Aerofin Heating Coils.



Ilgair Unit Heaters can be connected to the outside for introducing fresh warm air. Note by-pass connection in the picture.

No other active industry has as acute heating problems as confront the garage man. He is paying for heating two thirds of the space that is never used. He also needs fresh air to replace and force out automobile engine exhaust gases.

Ilgair Unit Heaters are scientifically adaptable for this purpose. Send for Circular.

HIGH EFFICIENCY ILG VENTILATING MACHINERY

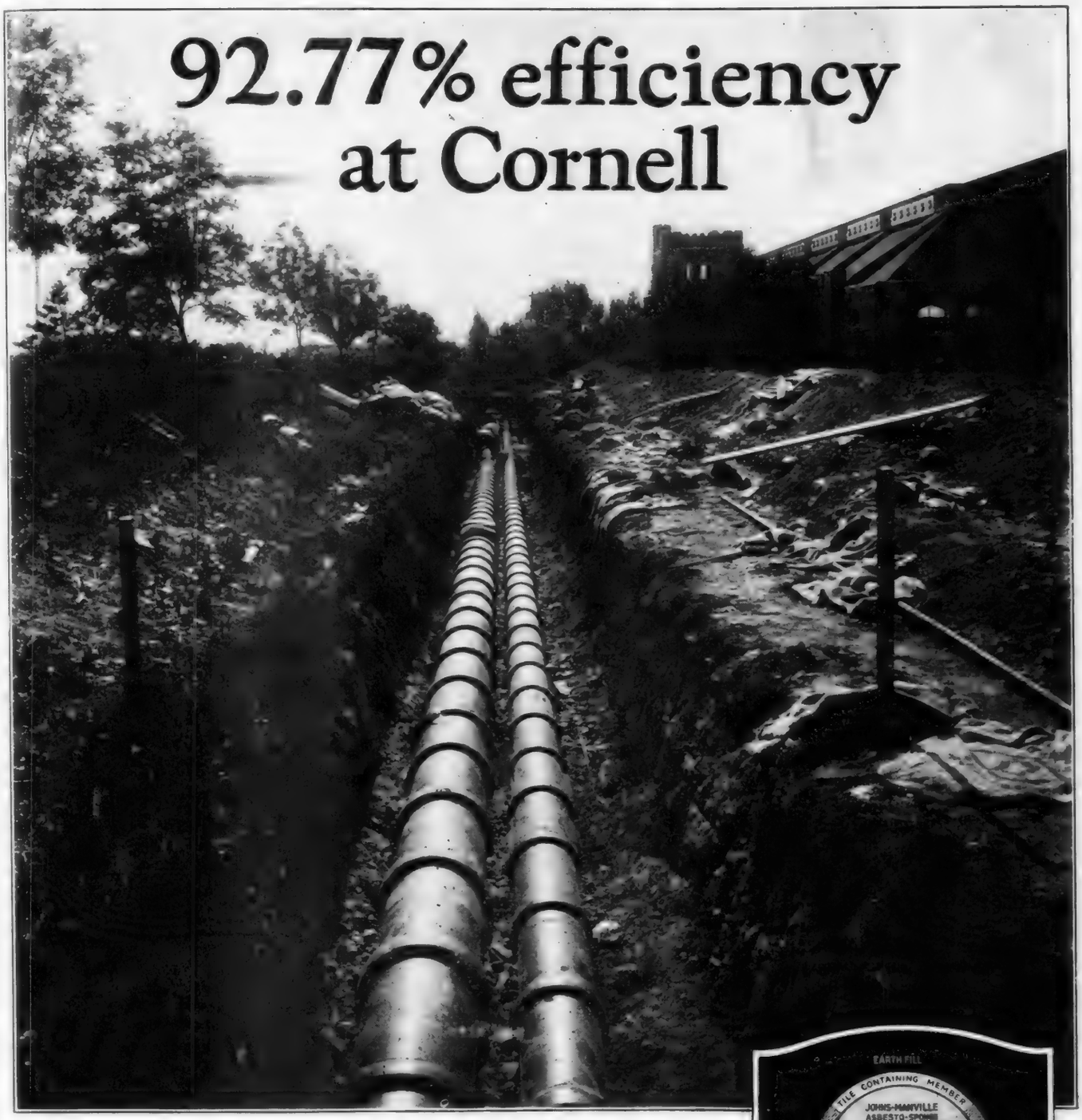
Ventilation

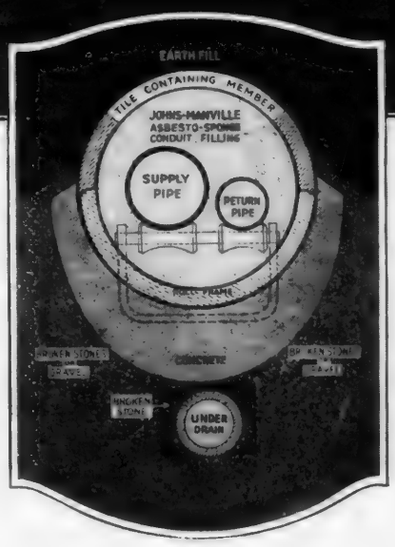
FOR OFFICES · STORES · FACTORIES · PUBLIC BUILDINGS · RESTAURANTS · THEATRES · HOUSES · ETC ·

ILG ELECTRIC VENTILATING CO. 2858 NORTH CRAWFORD AVE. CHICAGO

BRANCHES IN ALL PRINCIPAL CITIES

92.77% efficiency at Cornell





A CONDENSATION test of a 5,000 ft. section of the Johns-Manville Underground Sytem of Insulation installed at Cornell University, Ithaca, N. Y., showed an efficiency of 92.77% —2.77% better than the 90% stipulated in the contract.

This extra 2.77% represents an extra saving of 85 tons of coal per year for the University on this tested section alone—which is only part of a 19,400 ft. installation.

Count on the Johns-Manville system not only to meet requirements but to beat them—by a good margin.

JOHNS-MANVILLE INC., 292 MADISON AVENUE AT 41st STREET, NEW YORK CITY
Branches in 62 Large Cities For Canada: Canadian Johns-Manville Co., Ltd., Toronto

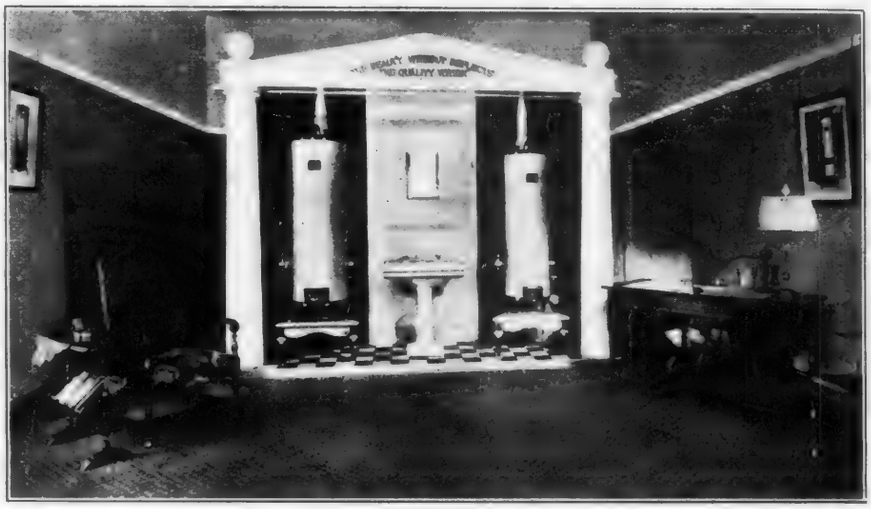
JOHNS-MANVILLE

Underground System of Insulation

opening of a sales office in Birmingham, Ala., in charge of Haydn Myer. The Birmingham office is located at 1218 Age-Herald Building.

Continental Heater Corporation, Dunkirk, N. Y., manufacturer of the Continental line of low water-line boilers, square sectional boilers, radiators and Contento boilers, announces the appointment of Haydn Myer, formerly of the American Radiator Company, as its southeastern representative, with headquarters in Birmingham, Ala., at 1218 Age-Herald Building.

EverHot Heater Co., Detroit, Mich., announces the addition to its executive staff of Elmer E. Ledbetter, as director of distribution. For a number of years Mr. Ledbetter has had charge of distribution for a large Chicago specialty house. Previous to going to Chicago he was affiliated with one of the older water heater companies for six years. The greater part of this time he was associated with Frank W. Shuell, president of the EverHot Heater Company. The company has arranged a particularly attractive display of its product in its new Cass Avenue salesroom, in Detroit, the store occupying a prominent location in "Water Heater Row," several of the leading water heater companies having their Detroit salesrooms on the same side of the street in close proximity to each other. The desks of the city salesmen and office force are located at the back of the room, behind the heater display. The interior of the salesroom is furnished in period walnut furniture.



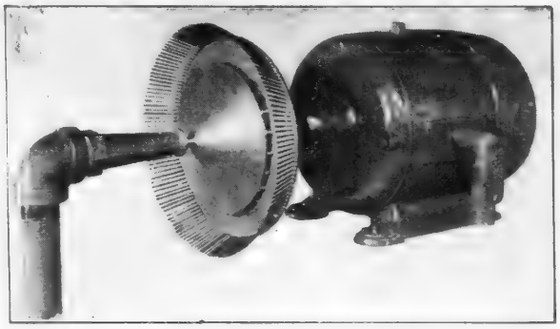
Display of EverHot Heaters in New Salesrooms of the EverHot Heater Company, in Detroit

New Incorporations

Uno Ventilator Co., Saugus, Mass., capital of $50,000. Incorporators: Matthew J. Tobey, Winchester, Mass., and Lilly A. Tobey, Jamaica Plains, Mass. The company will manufacture ventilating systems.

Standard Oilgas Heating Co., 405 No. Washington Ave., Lansing, Mich., capital $20,000, to manufacture gas-making and oil-burning apparatus. Martin J Somers, president; Louis F. Breitenwischer, first vice-president; Ned E McLaughlin, second vice-president; James Collins, secretary and John L. Bush, treasurer.

Rhode Island Heating and Equipment Corp., Providence, R. I., capital $100,000. Incorporators: Thomas Hampson,



The Turbo Atomizer

The Turbo Atomizer is the heart of Bayley Air Washing Systems. It does away with multiple orifice sprayers which are easily clogged and which produce a spray not altogether free from holes.

It operates with low current consumption and at very low water pressure, throwing an even, finely divided spray radially against the walls of the washing chamber.

Three Types are Built Around this Principle

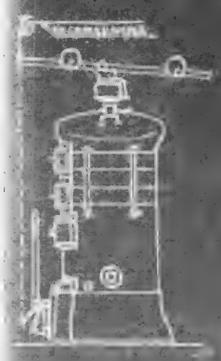
Type "A" **For washing and humidifying (cleaning).** The Type "A" Washer is installed where cleaning is the primary consideration. It uses the water over and over, and removes 98% of foreign matter from the air. Humidity may be added as desired.

Type "B" **For washing and de-humidifying (cooling).** For cooling air, the cleaning being incidental, Type "B" Washer, consisting of tandem sprays, is installed, and is capable of bringing the temperature of the entering air practically to the water temperature.

Type "C" **For washing without humidifying (drying).** Where clean air for drying processes must be obtained without increasing its humidity, the Type "C" Washer is installed, using a special washing emulsion.

Bayley Manufacturing Company
742 Greenbush Street
MILWAUKEE

Standard Equipment On All These Steam Boilers

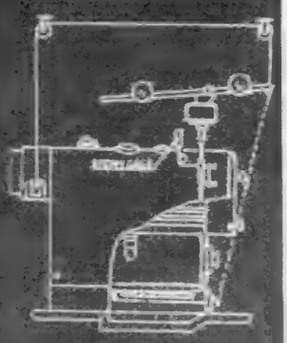


Floral City

Abco
Abendroth
Ames
Bernhard
Birchfield
Butler
Coatesville
Coil
Floral City
Kewanee
National
Newport
Novelty
Oil City

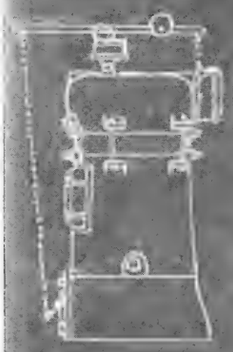
Pebco
Pierce
Prox
Richardson-Simplex

Also Keystone boiler and Economy boiler with No. 924 Sylphon Damper Regulator as standard equipment.



Birchfield

No. 20 Sylphon Damper Regulator for low pressure steam boilers

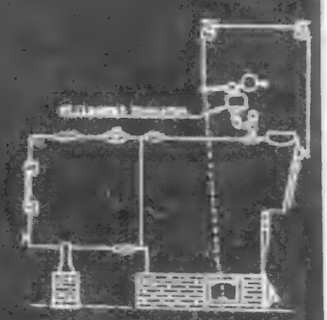


Richardson

Every Coal Fired Boiler Burns Coal and "Air"

—*the coal costs money—the air is FREE*

A BOILER, that in the language of the householder, is "a hog for coal," is bad business for both the householder and the boiler manufacturer. The 21 leading manufacturers who have standardized on equipping their boilers with Sylphon Damper Regulators *know* that these regulators will feed just the right amount of air to economically burn a minimum of coal, obviate all overheating or underheating, and prevent for all time the necessity of running up and down stairs to adjust drafts.



Oil City

The secret of the Sylphon accuracy is the Sylphon Bellows

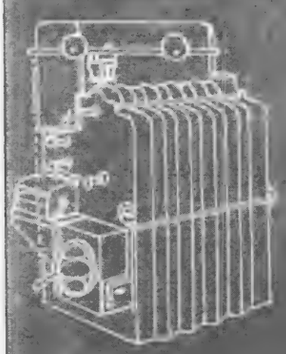
This bellows, drawn from a flat sheet of metal *without soldered seam* is at once the most flexible and powerful expansion member known to engineers. There is only *one* Sylphon bellows. It is made by The Fulton Company of Knoxville, Tennessee, and is used exclusively in Sylphon Damper Regulators.

Other famous Sylphon Damper Regulators are

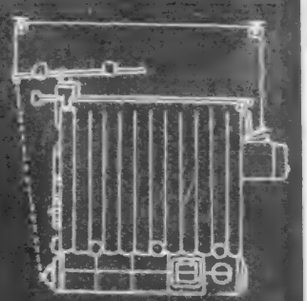
No. 45-A for hot-water boilers; No. 925 for vapor heating systems; No. 924 for low pressure (down to 6 ozs.) steam boilers.

All Sylphon Damper Regulators are made in standard iron pipe sizes and may be used on any make of boiler. Jobbers carry stocks.

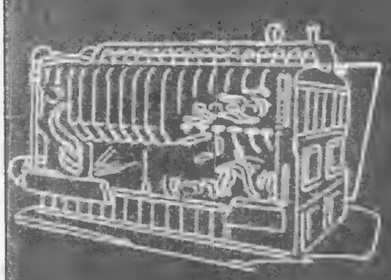
Ask for Bulletin DR



Newport

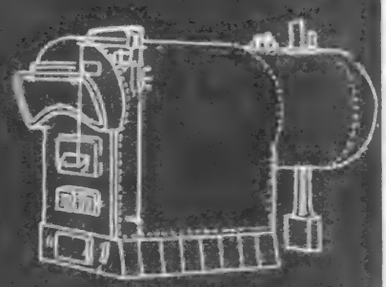


National



Prox

This can be done hundreds of thousands of times—
AND NO APPRECIABLE LOSS OF FLEXIBILITY WILL DEVELOP IN THE ALL METAL SEAMLESS SYLPHON BELLOWS
Sylphon



Kewanee

THE FULTON COMPANY, KNOXVILLE, TENN.

New York Chicago Detroit Boston Philadelphia *Representatives in all principal cities in U. S.*

European representatives: Crosby Valve & Engineering Co., Ltd., 41-42 Foley Street, London, W. 1., England

Canadian representatives: Darling Bros., Ltd., 120 Prince Street, Montreal, Canada

Myrtle D. Wentworth and Gladys L. Potter.

Cooke Boiler Works, 265 Nichol St., New Haven, Conn., capital $50,000. The company will manufacture boilers, heaters and tanks.

Denver Oilomatic Heating Co., Denver, Colo., capital $10,000, to manufacture oil-burning apparatus.

Ray-dio Oil Burner Co., Central Falls, R. I., incorporated to manufacture oil-burning equipment. F. H. Keran is president of the company.

New Firm

Hubbard & Lange, Inc., heating and ventilating engineers and contractors, Grand Central Terminal, New York, has been organized to succeed the firm of Teran & Lange, at the same address. The new member of the firm, William W. Hubbard, secretary and treasurer, was formerly in charge of the heating department of W. G. Cornell & Co., New York, where he handled the design of the mechanical equipment of many large and important buildings. Mr. Hubbard's many friends in the heating field will wish him success in his new venture.

Chamber of Commerce of United States on Trade Associations

In a statement setting out the principles upon which the Chamber of Commerce of the United States lays emphasis as especially timely, its attitude on trade associations was expressed as follows:

After noting the fact that trade associations form about one-third of the constituent membership of the chamber, the Chamber of Commerce expresses the belief that trade associations, legitimately conducted, are an essential element to the promotion of American Business and that legislation which would make them impossible, or make it impossible for them to function properly would hinder not only industry but also the prosperity of the nation.

After commenting upon the harm done to trade associations in general, due to the way in which prosecuting authorities of the government have proceeded under the Sherman Act, causing doubt in the public mind, not only as to the trade associations against which action has been instituted, but as to trade associations against which apparently no action whatever has been contemplated, the statement continues:

"Trade associations serve a very useful purpose which is generally overlooked. In the prosecution of trade associations the public, and perhaps to some extent the authorities, regard the trade associations as representing corporations with huge accumulations of capital. The fact is that the larger and richer the corporation, the less its needs for a trade association. It has, in itself, the means of obtaining all of the information which it needs in order successfully to compete. Not so with the smaller concerns. They cannot afford, except through pooling their interests through a trade association, to secure this business data at their own expense.

"The membership of the national chamber, through a referendum vote has made the following recommendations regarding the use of statistics by trade associations:

"Statistics of capacity, production, stock and sales, and statistics of actual prices in closed transactions, should be collected by a trade association for its industry or branch of commerce.

"Such statistics should be distributed without any comment or interpretation which could induce or facilitate concerted action on the part of members.

"The statistics should be made as available by a trade association to the public and government agencies as to the members of the association.

"It is the duty of the chamber's board of directors to advocate the carrying into effect of these recommendations. In so doing it has to consider, not its own opinion of the legality of the activities which are included, but the

PUBLIC SCHOOL No. 62, BRONX, New York City, N. Y.
Over one Hundred Lehigh Fans are installed in New York City Schools
Engineers—New York Board of Education.
Contractors—Federal Heating Co., New York City

LEHIGH MULTIBLADE FANS

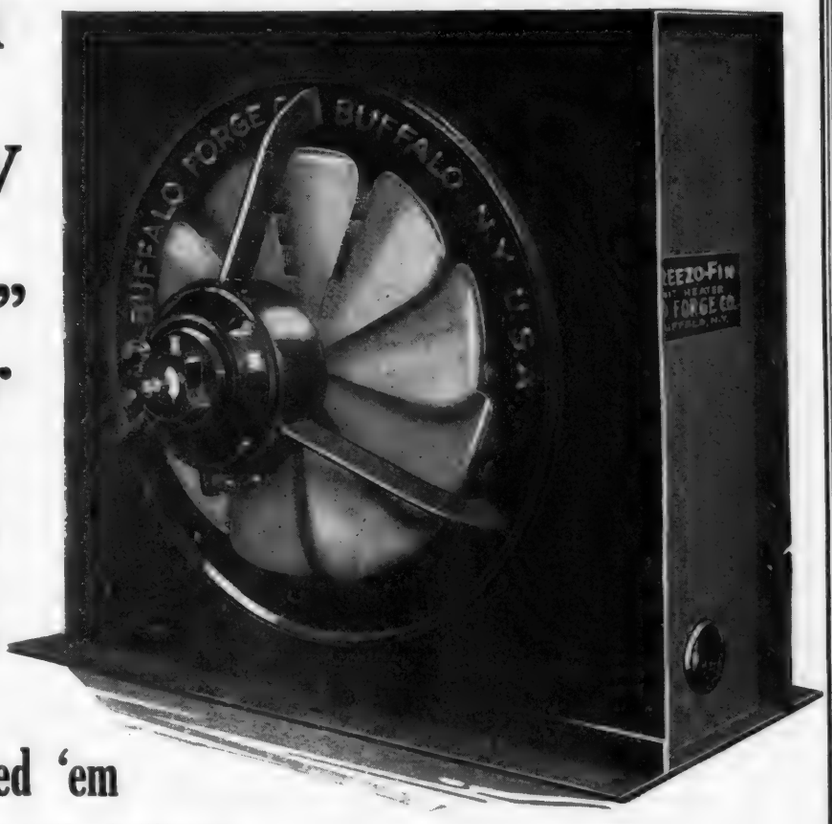
FOR HEATING AND VENTILATING

WHERE large volumes of air are to be handled at comparatively low pressures such as in heating and ventilating systems LEHIGH Multiblade Fans are guaranteed to be equal to, if not superior to, any other fans on the market.

HERSH BROTHERS CO.

654 Mill Street ALLENTOWN, PA.

If you need more heat RIGHT NOW get a "Breezo-Fin" Unit Heater



For garages, shops and warehouses. Have brass steam coils and excel in lightness and strength. The fan and motor are as good as can be made and the space each unit can heat will surprise you.

Take 'em where you need 'em

Where steam is not available as in rural schools, storerooms, garages and some warehouses use a

"Buffalo" Direct Fired Unit Heater

It is easily installed and complete in itself. Set it on an ordinary floor, connect smoke pipe and motor, and it is ready to deliver 1450 to 2000 cu. ft. of air per minute at 70° and show only 4 or 5° difference between temperature at ceiling and floor, so uniform is the temperature it maintains.

There is nothing to freeze up over Sundays and holidays and no skilled engineer is required for its operation.

Motor requires oiling but once a year.

This heater not only provides the quickest, most uniform, and economical heat for its purpose but may be the means of saving about 50% of your coal bill.

Burn buckwheat coal and use our Buffalo Coal Burner to supply forced draft.

Any kind of fuel desired may be used.

Write for literature.

BUFFALO FORGE COMPANY

480 Broadway Buffalo, N. Y.

A-60

attitude of the government and its officials who have relations to the question. If it is forced to a conclusion that the view is held in government circles there is illegality in activities the chamber's members have declared are desirable, it must consider seeking from Congress such minor amendments as will affirmatively permit the activities it advocates. Parenthetically, it may be added that obviously the chamber does not seek repeal of the Sherman law."

The chamber's position on this, as well as on a variety of other subjects have been put before President Coolidge, in person, by Richard F. Grant, president, and Elliot H. Goodwin, resident vice-president of the chamber.

A HALF-CENTURY OF PRICES AND WAGES IN THE CONSTRUCTION INDUSTRY, 1874–1924, setting forth the trend of construction costs during the last fifty years, compiled by *Engineering News-Record* was presented at the recent meeting of the Editorial Conference of the Associated Business Papers. Graphs were included of both materials and wage rates. The graph of materials covered brick, lumber, cement, steel structurals, wrought-iron I-beams and lime. The wage graph brought out in a striking manner the high point reached by wage rates in the skilled trades in New York, which are now at their peak for carpenters, bricklayers, structural ironworkers and hod carriers. The only drop recorded is for common labor, the wage rate for this class now being 60½ cents per hour.

In discussing conditions in the construction, the point was brought out that while industrial building is falling off, every other kind of building is keeping up. It was predicted that construction labor would not drop, as there not enough skilled laborers in the market. For this reason it is expected that the cost of construction will be maintained at the present level. While on small buildings there has been no improvement in the efficiency of the workmen, a distinct improvement had been noted on big construction projects. Winter construction, it was shown, is on the increase.

CONDENSED CATALOG OF MECHANICAL EQUIPMENT, 1924–1925 edition, is ready for distribution. The main reference features of this work are three in number: Catalog section, directory of mechanical equipment or buyers' guide, and professional engineering service directory. The book is printed on super bible paper and bound in blue flexible Atholeather, with lettering in gold. Price $5.00 (to members of the A. S. M. E. $4.00). 7 in. x 10 in. type-size page. Pp. 525. Published by the American Society of Mechanical Engineers, 29 West 39th Street, New York, or may be had through the book department of THE HEATING AND VENTILATING MAGAZINE.

WANTED

Advertisements under this heading, $2.00 per inch, payable in advance. A 1-in. advertisement contains 35 words. To secure insertion copy must be received not later than the 20th of the month preceding date of issue.

SALES REPRESENTATIVE WANTED—By manufacturer of heating specialties. Must have knowledge of steam and vapor heating. Write giving age, experience, salary expected and when available. Address Box 121, care Heating and Ventilating Magazine.

POSITION WANTED—Steel and cast-iron boiler and radiator sales executive, organizer, manufacturing and jobbing experience. High calibre. Can expand your business. Available January 1. Address Box 123, care Heating and Ventilating Magazine.

WATCH THE CANADIAN MARKET—We offer facilities in Canada for manufacturing, assembling, warehousing or distribution. Coast-to-coast connection in heating trade. Address Box 124, care Heating and Ventilating Magazine.

POSITION WANTED—Available at once, capable heating engineer for position of heating estimator, sales engineer or assistant sales manager. Graduate engineer, 28 years old, with excellent experience. Can furnish A-1 references. Willing to locate anywhere. Open for immediate acceptance. Address Box 122, care of Heating and Ventilating Magazine.

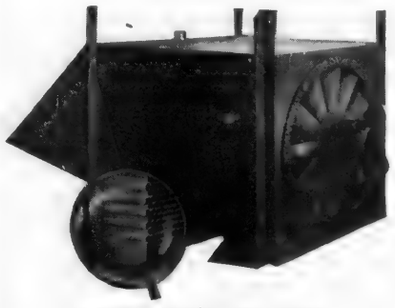
COLD WEATHER IS COMING

Why Let That Unheated Building Worry You

We manufacture Unit Heaters and Fan Heating Systems for every need. If steam is not available, our all steel direct fired Fan Furnace will meet your requirments.

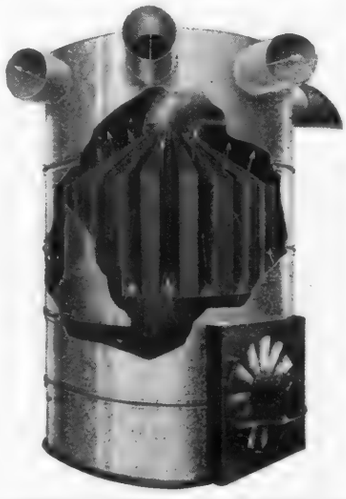
Send us your heating problems and we will show you the easiest and cheapest way.

Recommendations and prices furnished cheerfully without cost to you.



COMET UNIT HEATER

Suitable for use where steam and hot water is available. This Heating Ace is especially adapted where compactness and lightness in weight is of importance. For complete description write for Bulletin No. 85.

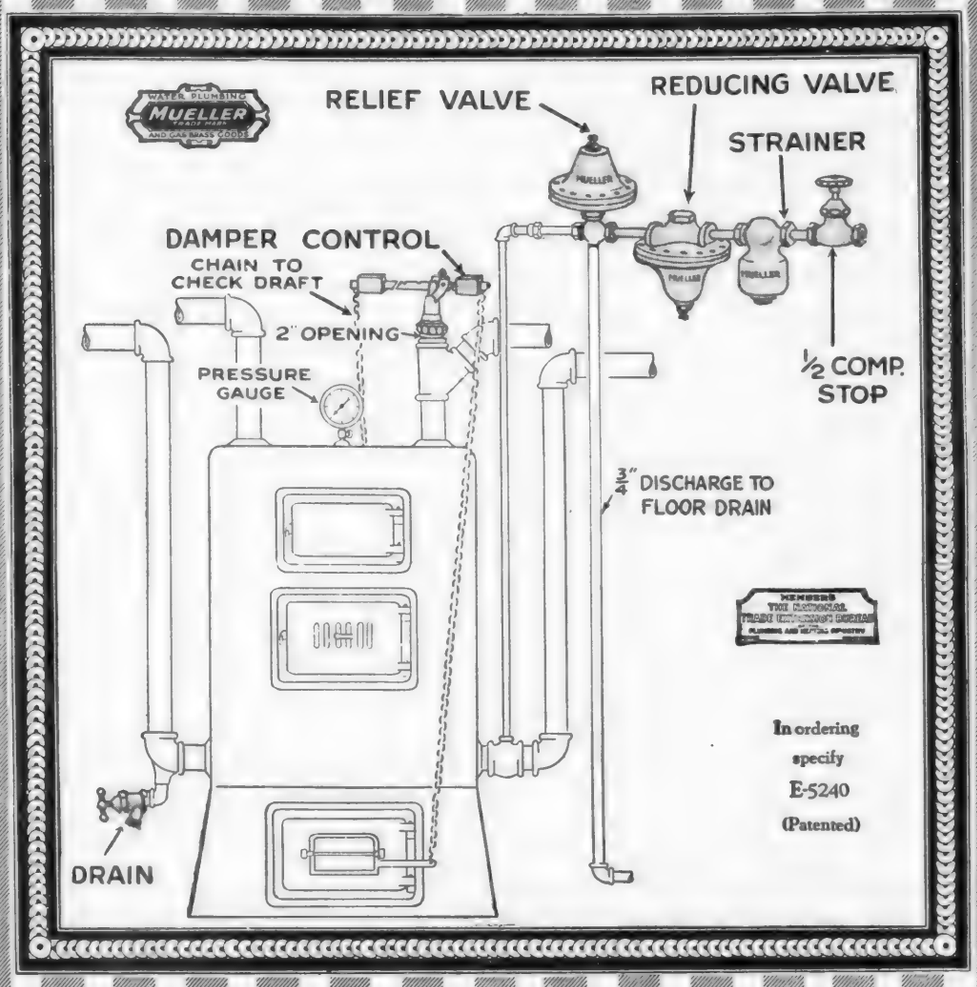


DIRECT FIRED FAN FURNACE

For use where steam or hot water is not available. For complete data write for Bulletin No. 90.

THE NEW YORK BLOWER COMPANY

CHICAGO, ILL. *Branch Offices in Principal Cities* LA PORTE, IND.



MUELLER

Automatic System of Hot Water Heat Control

has no unsightly and expensive expansion tank — it operates directly on city water pressure—it is shipped assembled and can be installed in an hour's time—and then it works satisfactorily and efficiently.

Does Its Work Automatically

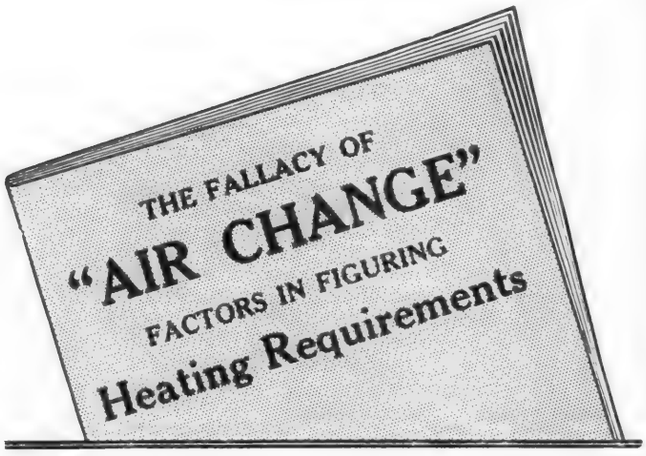
After the Mueller System is installed and in operation, the owner pays no further attention to the valves—they work automatically—thousands of users testify that they do this faithfully.

The simplicity, dependability and reasonable cost of the Mueller System have created a big demand for it and made it an easy seller.

Write for booklet and prices.

Mueller Co., Decatur, Illinois, U. S. A.

145-149 W. 30th St., New York: 1072-76 Howard St., San Francisco; 2468 Hunter St., Los Angeles



A remarkable book on air infiltration

And what four men who read it wrote

"The development and dissemination of such engineering facts cannot help but benefit the entire profession."
R. C. HOUGHTON, Sec'y., A. S. H. and V. E.

"Agreed we can take a step towards the desired end by eliminating the air-change basis and, if necessary, make an allowance for the unknown factor of infiltration thru building materials."
A. S. ARMAGNAC, Pres., Heating and Ventilating Magazine Company.

"You are doing a great deal to advance the science of heating buildings. It has been due to a lack of knowledge that this method (air infiltration) has not been widely accepted long before this."
H. M. HART, L. H. Prentice Co., Chicago.
(Mr. Hart is a member of the Standards Committee, National Piping Contractors' Assn., and member Research Committee Heating and Ventilating Engineers' Society.)

"You have presented a strong case for the infiltration method of computing heating requirements of buildings to offset air inleakage."
A. C. WILLARD, Professor, Heating and Ventilation, and Head of Dep't of Mechanical Engineering, University of Illinois.

"The Fallacy of the Air Change" touches bottom on a subject vital to the entire engineering profession—control of air infiltration around windows and doors. Explains why modern building methods and materials have rendered obsolete old methods of estimating radiation. Contains a whole chapter on relation of window crack to room content; another on air inleakage around window openings; and more than 27 charts and tables.

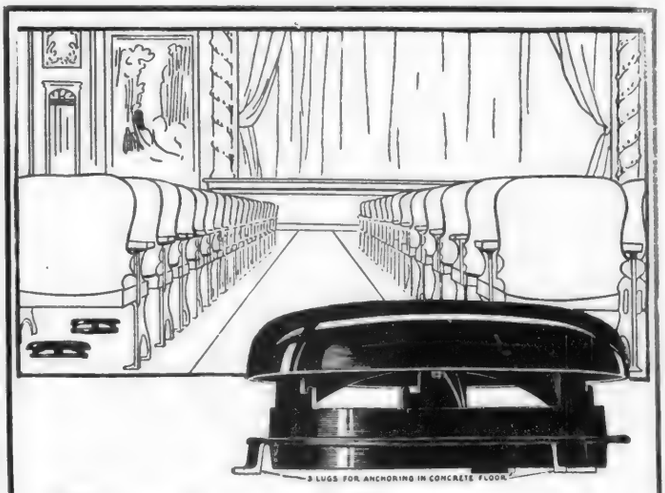
Explains only possible way to arrive at *unchanging* factors for estimating required radiation—shows why a small heating plant designed with an accurate knowledge of conditions will operate more satisfactorily on less fuel than a large one designed on a guess-work basis.

Not For Sale

"The Fallacy of the Air Change" cannot be bought anywhere at any price. But while a limited edition lasts we will send copies, with our compliments, to engineers who would like to read this remarkable booklet. We will also enclose with it a leaflet containing a ready reference table of b. t. u. losses to be kept on your desk for use when figuring radiation. Please use your business letterhead. No obligation, of course.

MONARCH METAL PRODUCTS CO.
5060 Penrose St. **St. Louis, Mo.**

Manufacturers of Monarch Metal Weather Strips—Interlocking Type No. 400—Standard Control of Air Infiltration.

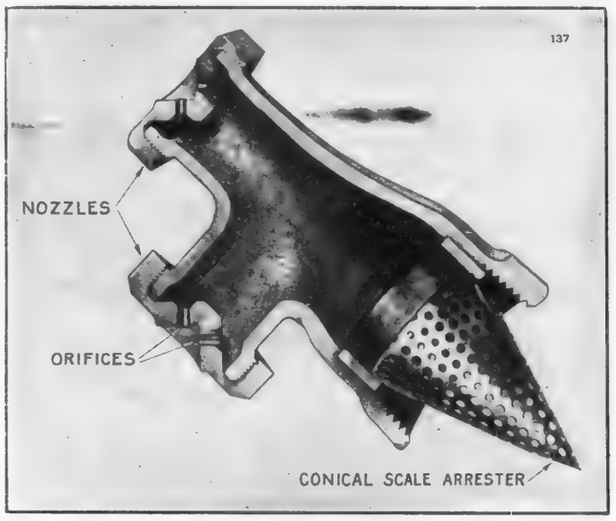


There's a difference

Air diffusers may have much the same appearance but —there's a difference.
Many fatal experiences have attended those who ate what they *thought* were mushrooms—only to find them to be toadstools.
To be sure of satisfactory air diffusers, specify KNOWLES NOTCH MUSHROOMS. They have become a standard specification with many architects and heating engineers.
KNOWLES NOTCH MUSHROOMS are adjustable and rigid. Tops are smooth and there are no set screws to become loosened by vibration.

Ask for our new booklet H.

KNOWLES MUSHROOM VENTILATOR CO.
202 Franklin St. **NEW YORK CITY**



THE IMPACT AIR WASHER

The cut indicates a longitudinal section through a spray head, showing the two impact nozzles with their smooth, round orifices, entirely devoid of obstructing vanes or spiral passages. The conical scale arrester, with its numerous holes, each smaller than the nozzle orifice, intercepts and retains all dirt and scale large enough to plug the nozzles. During this slow accumulation the nozzles spray at full capacity.

Ask for Booklet K.

THE COOLING TOWER CO., Inc.
15 John Street, **New York**

C. E. J. Snyder Architects — *Thomas Jefferson High School, Brooklyn, N. Y.* — *Gillis & Geoghegan, Contractors*

In the Borough of Brooklyn

HERE, again, Sturtevant Heating & Ventilating Apparatus efficiently supplies adequate heat and ventilation to those who use this institution of learning.

Of course, the agreeable atmosphere in the Thomas Jefferson High School was made possible by the installation of our supply and exhaust systems.

Throughout this building, over 300,000 cubic feet of air per minute is constantly circulated by Sturtevant Supply Fans, and the vitiated air is completely carried away by the Sturtevant Exhaust Units.

Architects and engineers who specify Sturtevant Heating & Ventilating Apparatus for their buildings get reliable equipment that performs properly in accordance with their plans.

B. F. STURTEVANT COMPANY

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Dallas, Tex. — Salt Lake City, Utah
Detroit, Mich. — San Francisco, Cal.
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Plants located at

Hyde Park, Mass. — Berkeley, Cal. — Camden, N. J.
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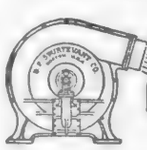

Sturtevant
PUTS AIR TO WORK

Foreign Representatives

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American Trading Co. — Tokio
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Catton Neill Eng. and Mach. Co. — Manila
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Blair, Reed & Co. Ltd. — Wellington
Wesselhoeft and Poor — Caracas
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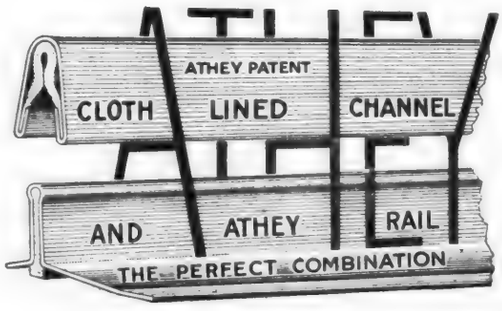


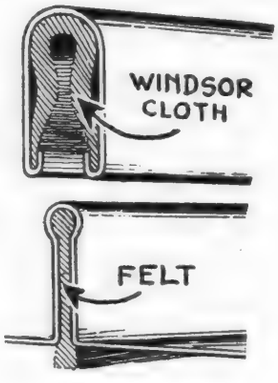
The only *cloth-lined* metal weather strip

The "Last Word" in Weatherstrips

It is impossible to fit two pieces of metal close enough to keep out drafts and dust ***without making the windows stick.*** In the Athey Strip the metal rail runs ***smoothly*** and ***easily*** in a metal channel lined with cloth.

The cloth hugs the rail so tightly that drafts, dust and noise can't sneak around it —or through it. *Yet the windows open and close easily.*

The metal channel and rail are of imperishable zinc. They will not rust. The cloth is guaranteed by us to be rot-proof, damp-proof and moth-proof. Water or ice will not affect it. And it won't pull out of the channel.



We will be glad to give you a list of prominent buildings all over the country where Athey Cloth-Lined Metal Weather Strip is used. Ask the owners —test it in the most severe manner. It will make good—it has made good. And that is why you find it used almost universally in buildings where only the finest equipment is good enough.

Athey Company

6027 West 65th Street . Chicago, Illinois

Wing Featherweight Unit Heaters

Will interest you because they—

—heat the floor first.
—weigh but 265 to 660 pounds and deliver from 92,500 to 599,400 B.T.U. per hour.
—are installed overhead thus conserving valuable space and leaving working floor unobstructed.
—come completely assembled and require but eight bolts for installation.
—require no belt as fan is carried directly on motor shaft.
—reduce cost of installation to a minimum since steam and return lines are usually carried overhead.

L.J.Wing Mfg.Co.

Fans and Blowers *Damper Regulators*
Unit Heaters *Small Turbines*

Hudson & 13th Sts. New York City

Lyon Toad Stools for Ventilation

Are Vent Caps of great strength, unobstructed throat, rigid non-rattling construction. The adjustment is from full open to full closed. The height of the floor m mber prevents sweeping dust and refuse into them. Their efficiency and economy make them particularly adaptable for theatres, auditoriums, etc.

Send for table of capacities and velocities

LYON PRODUCTS COMPANY

312-316 Union Park Court

Chicago - - Illinois

The World's Largest Building

The American Furniture Mart Building

Chicago, Ill.

Architect
Henry Raeder, Chicago

Associates
Geo. C. Nimmons & Co.
N. Max Dunning
Chicago

General Contractors
Wells Brothers
Construction Co., Chicago

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Chicago

BUCKEYE HEATOVENTS

were selected for this fine building because actual tests proved they were best. They are supplying over Seven Million Cubic Feet of warm, filtered air every hour.

For finer structures such as this, where the best in mechanical equipment is the standard, Heatovent is the logical choice of all ventilating systems. For Heatovent combines perfect mechanical operation with unusual dignity of appearance, simplicity, convenience and serviceability.

The simplicity of construction of Heatovent assures long life and service uninterrupted by mechanical troubles. Any contractor can make Heatovent installation without difficulty and at very low labor costs. In addition, this company maintains a corps of engineers always available for consultation with you.

Write our nearest branch office or direct to the factory.

The Buckeye Blower Company

COLUMBUS, OHIO

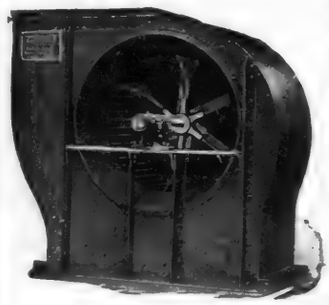
808 Monadnock Block, Chicago, Ill.
372 Whitehall Street, Atlanta, Ga.
Case & Morse, 1018 4th Ave. S., Seattle, Wash.
1400 Broadway, New York
813 George St., Baltimore, Md.
708-10 Columbia Bk. Bldg., Pittsburgh, Pa.
333 Jackson Building, Buffalo, N. Y.

The American Furniture Mart, Chicago, Ill.; Henry Raeder Architect, N. Max Dunning and Geo. C. Nimmons & Company, Associates; Wells Brothers Construction Company, General Contractors; James B. Lund, Heating and Ventilating Engineer. The building contains 1,500,000 square feet or over 30 acres of floor space. It is 16 stories high and contains 600 exhibit spaces.

THE AMERICAN FURNITURE MART HAS THEM!

MASSACHUSETTS MODIFIED SQUIRREL CAGE FANS

were selected for ventilating, The American Furniture Mart, the world's largest single structure, after the builders had made a thorough comparison of Massachusetts Fans with other ventilating equipment of recognized standing.



Single Width Squirrel Cage Fan

Massachusetts modified squirrel cage fans are especially adapted for heating and ventilating systems in schools, public buildings, factories and mills. They are made in standard sizes and capacities to meet every requirement for ventilation.

Massachusetts Squirrel Cage Fans backed by twenty-five years manufacturing experience are economical, efficient and dependable under all sorts of operating conditions.

Let us mail you our complete technical data concerning this Bishop & Babcock product.

MASSACHUSETTS BLOWER CO., WATERTOWN, MASS.

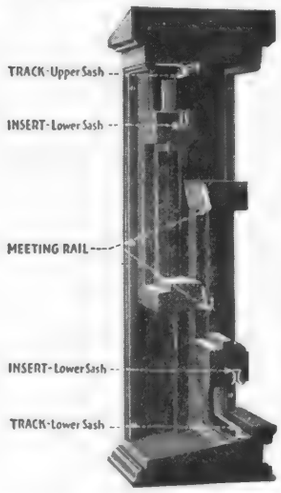
DIVISION OF

THE BISHOP & BABCOCK CO.

GENERAL OFFICES & FACTORIES - CLEVELAND, OHIO

Branches and Sales Offices in Principal Cities.

HIGGIN ALL METAL WEATHER STRIPS



The patent *Insert* strip makes Higgin Weatherstrips extra draft-tight

Higgin Weatherstrips are the only all-metal strips with the self-holding spring flange **Insert** in the sash. This **Insert** is important.

It makes a perfectly draft-tight contact at every point. Swelling or warping cannot prevent accurate fit and closure.

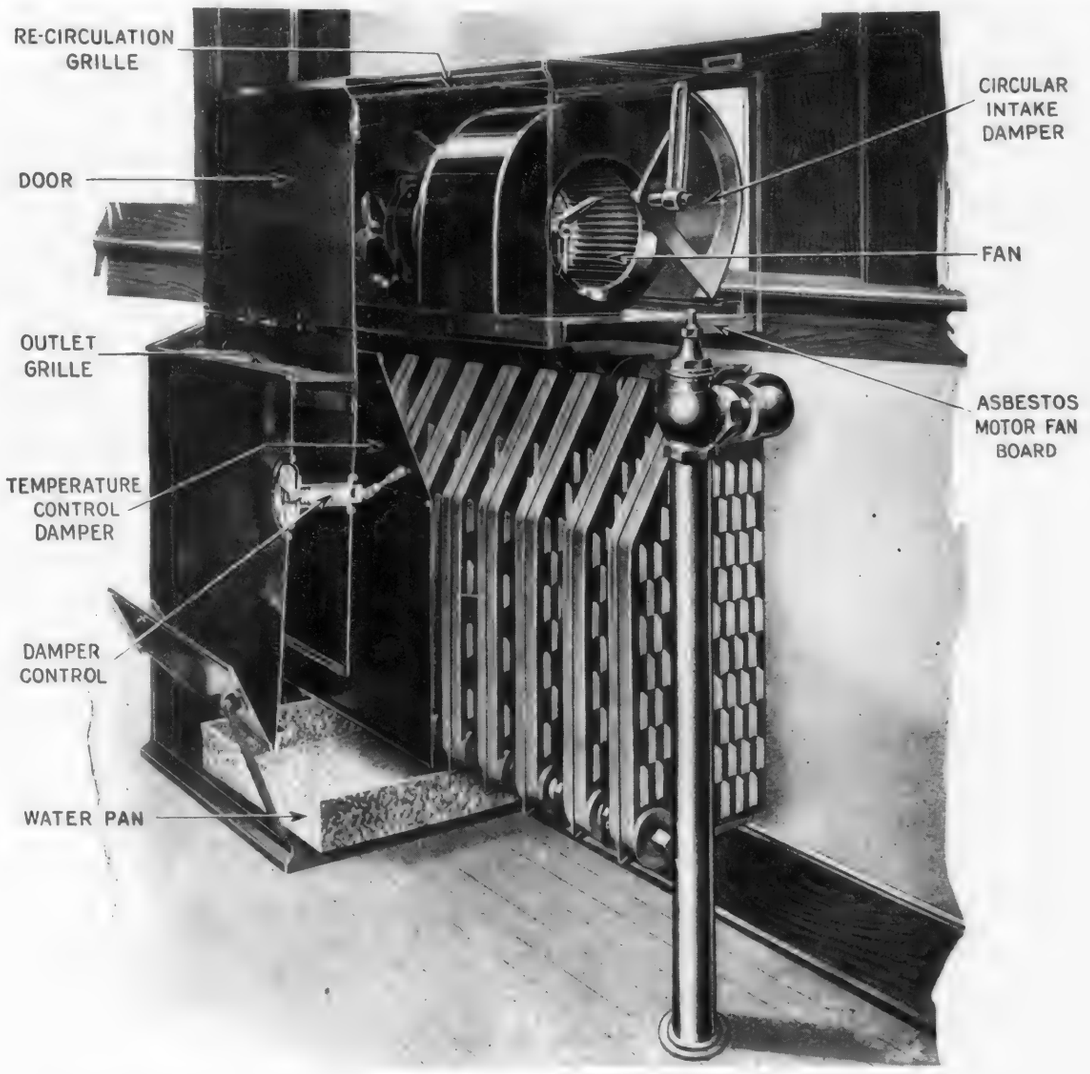
Without the Higgin Metal Insert the wooden groove will wear, swell or shrink, causing sticking or allowing seepage of air through the apertures.

Higgin Strips are "Metal against metal all the way round." Higgin-equipped windows and doors always keep cold air out and warm air in, operate smoothly and easily, and never need refitting.

HEATING ENGINEERS! You can safely guarantee a definite heating efficiency for your equipment when Higgin All-Metal Weatherstrips are installed. They keep all the cold air out and all the warm air in. They never lose their close fit by warping or shrinkage of frames. Every job is installed by trained Higgin men and guaranteed by the Higgin organization. Recommend Higgin All-Metal Weatherstrips to your customers.

The **HIGGIN** *Mfg. Co.*
Newport, Ky.
Toronto, Canada.

Manufacturers of Higgin All-Metal Weatherstrips and Higgin All-Metal Screens



The phenomenal success attained by the UNIVERSAL VENTILATING UNIT is in a great measure due to superiority of design and the quality of workmanship and materials used in its manufacture.

No expense has been spared in truly making the UNIVERSAL the standard by which all other makes are measured.

UNIVERSAL UNIT VENTILATION SYSTEM

The Standard by which all other makes are measured

Registered U. S. Patent Office

JOHN J. NESBITT

INCORPORATED

405 Lexington Ave.
NEW YORK CITY

Atlantic City
NEW JERSEY

Skinner Bros

Baetz Patent HEATING SYSTEM

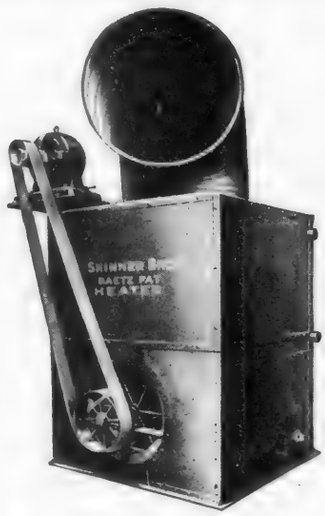
Heating Equipment Builded That Heats Your Factory or Plant Thoroughly

Uniform temperature, every hour of the day, on every floor, in every corner, all open spaces heated, none can escape no matter how cold it may be outside the building when Skinner Heaters are used. There is the satisfaction in having heating equipment that is builded for your requirements. Under such favorable conditions operators can do their best and biggest work and production is kept up, without stress, to its full capacity when you need it.

Performs with economy in every hour of operation

Skinner Bros Baetz Patent Steam Coil Fan-Blast Heater is a single enclosed unit which contains a series of steam coils compactly mounted over a powerful multivane fan wheel. This ductless heater is the pioneer and the originator of the ductless system for heating, ventilating and air conditioning of factories, industrial plants, mills and buildings, of every size and type, where steam is available. Fan operated by any power available. Use live or exhaust steam at high or low pressure. Completely assembled before shipment. Performance positively guaranteed when installed as directed by our engineers.

Among the Prominent Users of Skinner Systems Are:
Westinghouse Electric & Mfg. Co., American Stove Co., Roxana Petroleum Corporation, Brown Shoe Co., Morris & Co., Krey Packing Co., International Shoe Co., General Electric Co., Ford Motor Co., Fairfield Paper Co., Maxwell Motors Corp., National Enameling & Stamping Works, Standard Steel Car Co., Certain-teed Products Corp., Commonwealth Steel Co., American Brake Co., Crocker-Burbank Co., New York & Pennsylvania Co., International Paper Co.



Skinner Bros Baetz Patent Heater, Steam Coil Type S. C., uses live or exhaust steam at any pressure. Where steam is not available we furnish Skinner Bros Patented Direct-Fired Heater Type D. F., which burns coal, coke, wood, gas or oil.

¶ **Our trained staff of experts will advise, without obligation, with Executives, Engineers, Superintendents and Managers concerning heating, ventilating and air conditioning systems for buildings of every type and size.**

Skinner Bros Manufacturing Co. Inc.

Sole and exclusive manufacturers of Skinner Bros. Baetz Patent Heaters and Skinner Bros. Patented Direct Fired Heaters

Home Office and Factories, 1404 S. Vandeventer Ave., St. Louis, Mo.
Eastern Office and Factories, 124 Bayway, Elizabeth, N. J.
Sales Offices and Branches in all Principal Cities

AIR CONDITIONING TRADE MARK

APPARATUS for maintaining artificial atmospheric conditions in industrial plants.

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CONDITIONING CORPORATION
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SEE OUR DETAILED DATA IN A.S.H.&V.E. GUIDE

MANUFACTURED WEATHER
makes
"Every day a *good* day"
Humidification · Dehumidification
Heating · Ventilation · Purification
Drying
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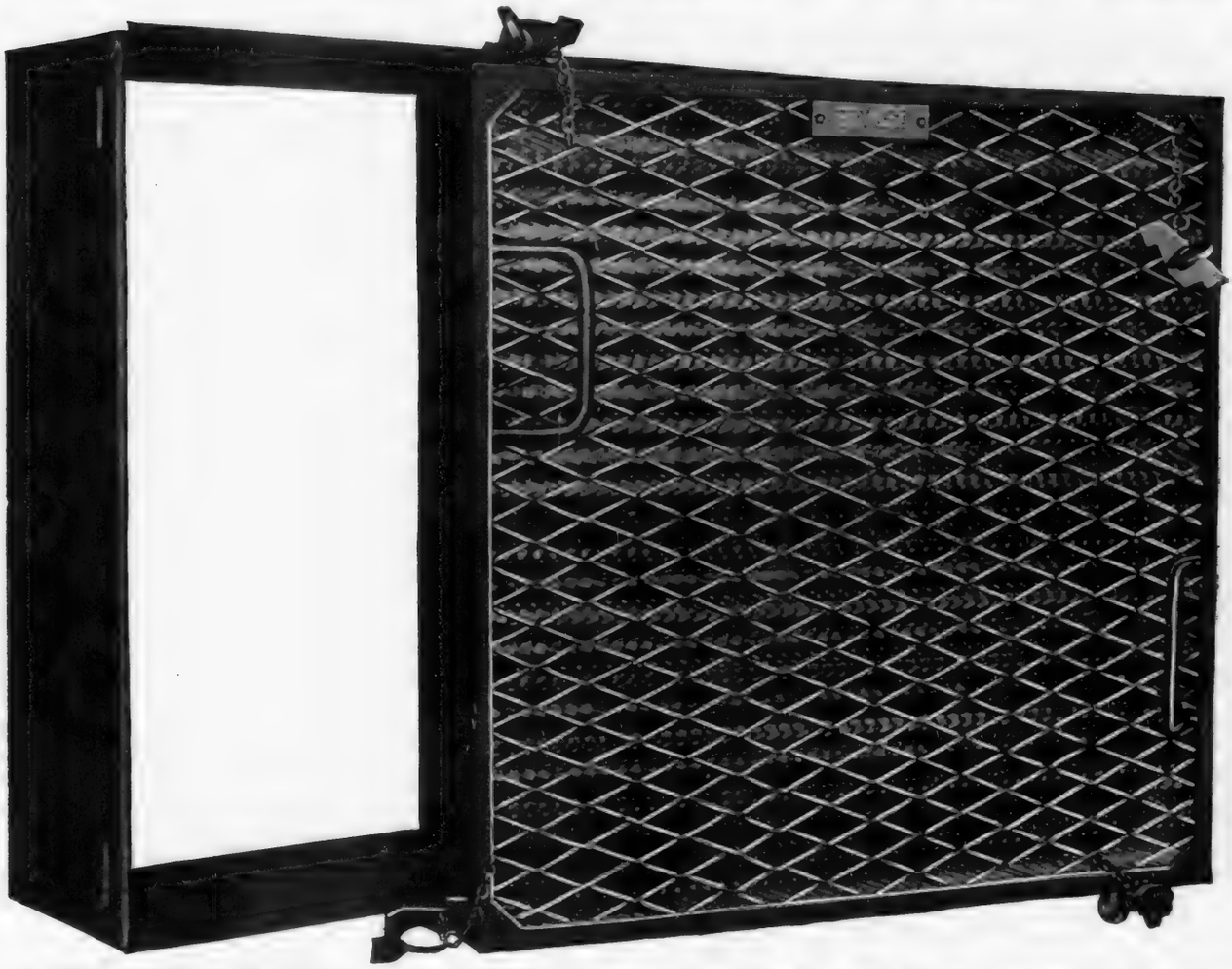
SEE OUR DETAILED DATA IN A.S.H.&V.E. GUIDE

Outstanding Features of the Midwest New Model U-2 Air Filters



1. INTERLOCKING FRAMES

The front of the filter frame is provided at top and one side with projecting lips which grip and interlock with adjoining frames. In the rear, behind the filter cells, the frames are bolted together, thus forming a double air seal between adjoining frames.

2. AIR TIGHT CONNECTION BETWEEN FRAMES AND CELLS

The filter cells fit bodily into the frames. The cells are pressed firmly against continuous flanges located in the rear of the frames by means of four locking clips with thumb screws, located in the front of the cells. Absolutely air tight joints are thus assured and yet the cells are easily removed and replaced in the frames.

3. ENLARGED EFFECTIVE FILTER AREA

Practically every square inch of the 20″ x 20″ area of the filter unit is utilized as effective filter area. The increase of effective area over previous and competing models is 25-30%. This means a corresponding increase in dust accumulating capacity, larger air capacity and lower resistance.

4. EFFICIENCY

While the filter principle is the same as in previous models the latest U-2 model has greatly increased the efficiency due to a better arrangement of the filter sheets and to the addition of a detachable sub-cell which catches any minute dust particles which might be able to find their way through the main cell. This increased efficiency has been accomplished without any sacrifice in operating resistance.

5. STURDINESS AND UNIFORMITY

The filters are built of sturdy and substantial material of ample stiffness and with welded joints. The filter sheets are made on automatic machines, insuring absolute uniformity of all sheets (which also insures uniformity of the filter cells both in respect to capacity and efficiency.) There is nothing in the filters which can deteriorate or become disarranged or dislodged. They are, therefore, everlasting and will need no repairs or renewals.

Our Department F-4 will be glad to send you complete information on the above equipment

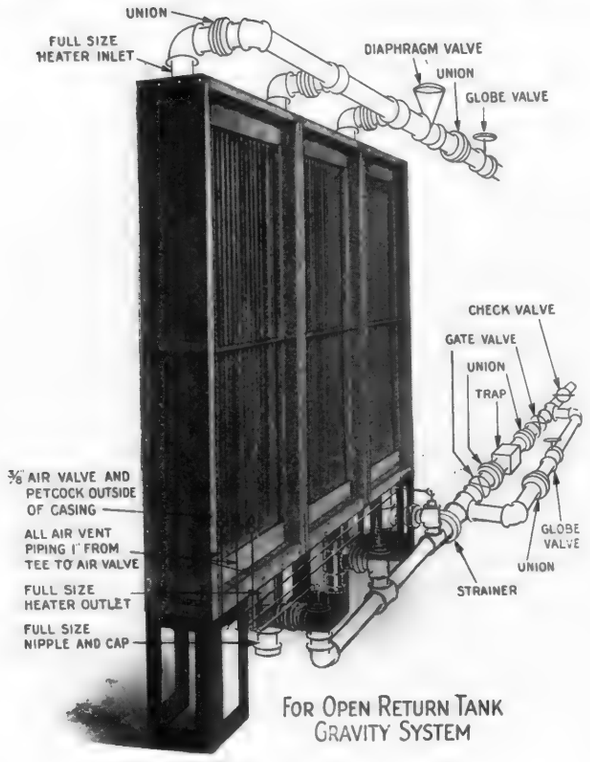
MIDWEST AIR FILTERS

INCORPORATED
100 EAST 45TH STREET
NEW YORK CITY

Offices in Principle Cities

Midwest Canada Ltd.
83 Craig St. West
Montreal, Canada

Midwest Air Filters Pacific, Inc.
Monadnock Building
San Francisco, California



FOR OPEN RETURN TANK GRAVITY SYSTEM

AEROFIN CORPORATION
750 Frelinghuysen Avenue
Newark, N.J.

L. C. Soule, *Sec'y and Chief Engineer*

AEROFIN

Fan-System Heating Surface

TO ENGINEERS AND ARCHITECTS:

Aerofin Saves Space and Weight

The light weight and non-corrosive features of Aerofin, together with its unit construction, space saving and because it comes to the job already encased and ready for steam connections, demonstrates its superiority, and for this reason we believe Aerofin merits being incorporated in your specifications. Since there is no equal to Aerofin, why not specify it outright?—At least, we ask you to mention the Aerofin in your specifications and to figure out the exact sizes and number of units required so that the contractor will know what to figure on.

TO THE CONTRACTOR:

Save Labor and Cost of Installation

Notice the unit construction which you find with Aerofin. Practically no labor of erection which means enormous savings in labor costs to you. Notice the small number of steam and return connections required with Aerofin. This feature also saves you money. Don't forget the saving in freight and cartage. Remember that the casing is already furnished as a part of the unit.

No extra reinforcement of the building construction required with Aerofin—may be suspended from ceiling with small angles and rods, without expensive platforms—may be handled with only ordinary care and assembled without using any block and tackle or scaffolding.

These features demonstrate that you can really save money by installing Aerofin altho the first cost, f. o. b. factory, may be a trifle higher than that of other fan-system heaters.

Illustration shows the ease with which several units high or wide of Aerofin may be assembled together by simply bolting thru the template punched flanges.

Aerofin Is Sold ONLY by Manufacturers of Nationally Advertised Blower Heating Apparatus.

AUTOMATIC

HEAT REGULATION

ELECTRICALLY OPERATED

Packless Electric Valve

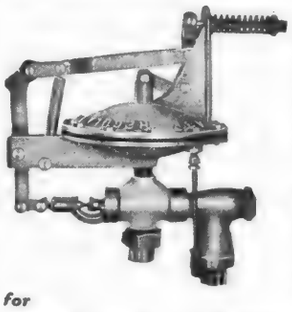
Instances occur every day where Automatic Regulation is desired in certain rooms. Gold's thermostat needs no air compressor, simply couple to the 110 volt lighting circuit.

Thermostat

WRITE FOR GENERAL CATALOG

GOLD CAR HEATING & LIGHTING CO.
BUSH TERMINAL
220 36th STREET BROOKLYN, N. Y.

A REMEDY FOR BALKY SYSTEMS



THE A & P AUTOMATIC HYDRAULIC VACUUM PRODUCER MAINTAINS CONSTANT VACUUM IN STEAM HEATING SYSTEMS

No tampering with air valves, foul air eliminated. No water hammering. Efficiency proved, merits investigation.

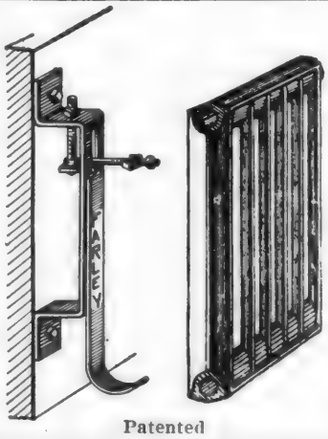
for
Churches, Schools, Residences, Theatres, Industrial Bldgs.

Ask for prices and Bulletin No. 1

A & P REGULATOR CO., Park Ridge, Ill.

FARLEY

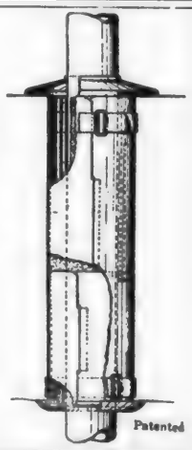
Hangers *and* Sleeves



Patented

This is the hanger you are looking for, made of hot rolled steel, will not break and made to fit any style of your radiation.

Fire resisting "Grab-on" sleeves are used in all classes of buildings. They are made to fit the condition of construction of the building. The only sleeve that will hold covering against the ceiling.

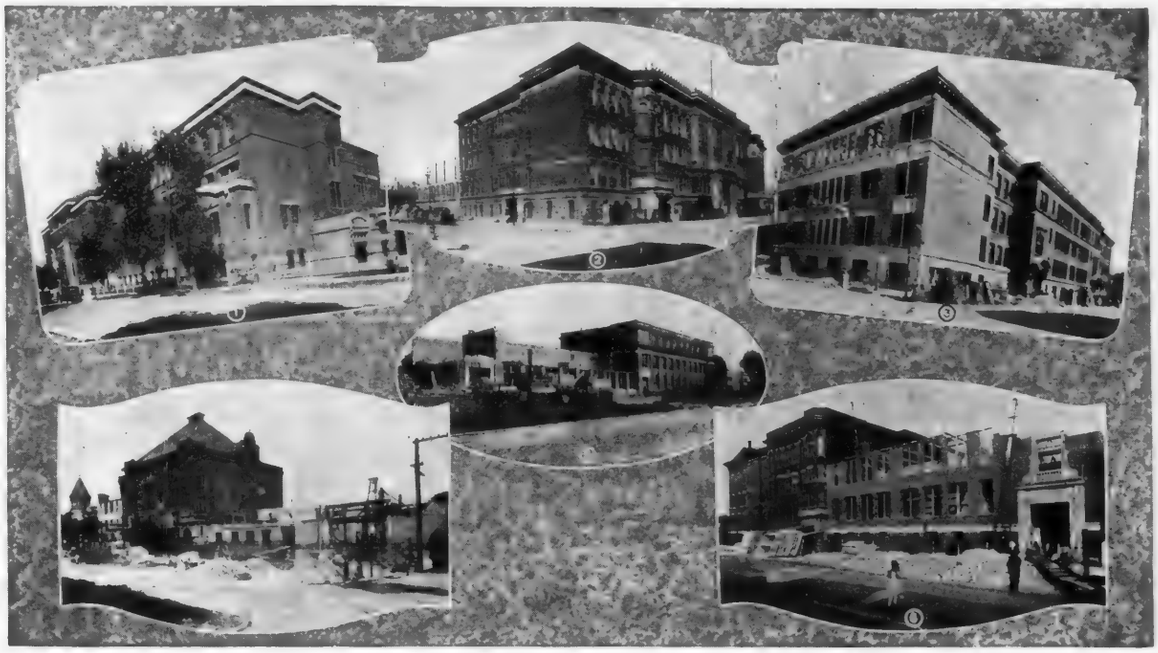


Patented

Send for descriptive literature

FARLEY SLEEVE AND HANGER COMPANY
3748 East 71st Street and Fleet Ave. Cleveland, Ohio

R E E D A I R I S C L E A N A I R



Other Schools equipped with Reed Air Filters

WEST HIGH SCHOOL
Denver, Col.

ELIAS MICHAEL SCHOOL
St. Louis, Mo.

BROOKLYN SCHOOL
Hibbing, Minn.

BRETANO SCHOOL
Chicago, Ill.

EMPORIA HIGH SCHOOL
Emporia, Kas.

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Six Chicago Schools

being equipped with REED AIR FILTERS

That Reed Air Filters meet the requirements of clean ventilation in cities like Chicago and Pittsburgh, having unusually dirty atmospheric conditions to contend with, is proof of their high cleaning efficiency.

Low first cost; simplicity of operation; low resistance to air flow; flexibility; ease of installation and high efficiency in the removal of dust, soot and bacteria are some of the advantages of the Reed System.

If you have a ventilation problem requiring clean air, our Engineering Dept. will gladly furnish complete information without cost or obligation.

REED AIR FILTER COMPANY, Inc.
Central Ave., Louisville, Ky. 50 Church St., New York City
Offices in Principal Cities

REED AIR FILTER COMPANY, Inc.
Engineering Department
215 Central Avenue, Louisville, Ky.

Gentlemen: Please send me without obligation your informative folder, "Are You Interested in Clean Air?"

Application.....C.F.M.

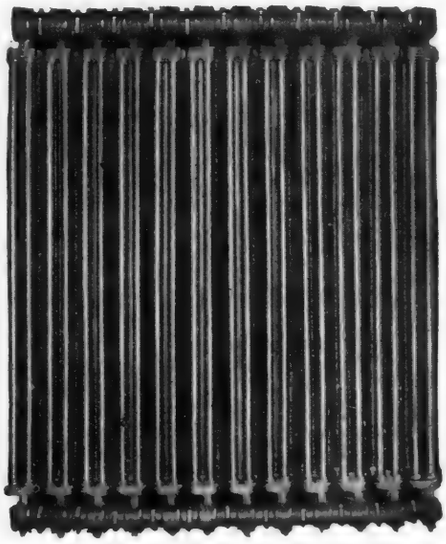
Name.....

Address.....

Reed Air

TRADE *filters* ALL METAL MARK

Why the Lyon Interlocking Heaters are Best for Hot Blast Heating



Front View of Lyon Heaters

Thousands of feet in daily use under pressure up to 100 lbs.

Some Territory Still Open to Reliable Agents

BECAUSE Guaranteed against cracked or broken sections under steam pressure up to 100 lbs.

—Light in weight, avoiding expensive foundations or supports where used on upper floors or roofs.

—Made to fit in space of any height from 40 inches to 140 inches in steps of 10 inches, thus avoiding piling up or decking.

—Made in small units that can be assembled in the building, and handled through any window, door or small opening.

—Heating surface closely assembled, thus giving greater heating surface in smaller space.

—All prime heating surface with the resulting high efficiency.

—Are pipe heaters, admitting steam at the top, the force of which drives the air down to the air vents at the bottom, thus assuring rapid and uniform circulation.

—Have all advantages of old style pipe heaters (in satisfactory use for forty years), with objectionable features of bulk and weight removed.

—Made of full strength Spellerized pipe, virtually rust and corrosion proof.

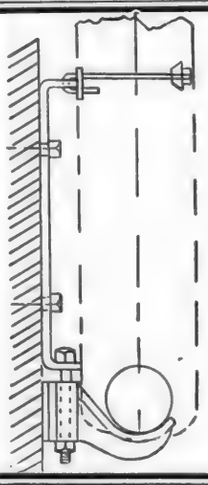
—Headers and bases are pressed in by hydraulic pressure without threading—sections assembled with extra heavy right and left nipples.

—Designed for extreme conditions, such as 40° below zero intake temperature and velocity up to 2000 feet per minute, under which conditions of temperature, humidity and velocity, the condensation becomes excessive.

—Price compares favorably with that of other heaters, and their light weight saves on freight. Cost of installation also much less..

Our 68 page catalogue of valuable engineering data now ready for FREE delivery to Architects, Contractors and Engineers of record—Write for it.

LYON PRODUCTS COMPANY, Inc.,
312-316 Union Park Court, CHICAGO, ILL.



CONVENIENT - SAFE - DURABLE

THE GLEOCKLE ADJUSTABLE RADIATOR BRACKET

Specifying Gleockle Wall Radiator Brackets means a saving of time and money and an assurance of absolute satisfaction.

They are designed and constructed by men who are thoroughly familiar with radiator bracket requirements, and embody all the features that constitute a convenient, safe and durable bracket.

Gleockle Wall Radiator Brackets are adjustable, easy to erect, inexpensible, invisible after erection, and will fit any make of wall radiator.

Patented

Send for descriptive booklet and trade discounts

A. F. GLEOCKLE, Jr. 415 Bay Street Rochester, N. Y.

KIELEY
REGISTERED TRADE MARK

Steam, Water and Air Specialties

Non-Return, Easy Repair Trap

Manufacturers of the Complete Line

Send for Catalog 1923

KIELEY & MUELLER, Inc.

Main Office and Works

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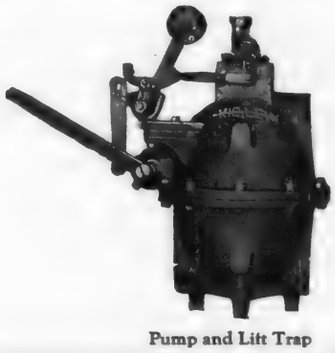
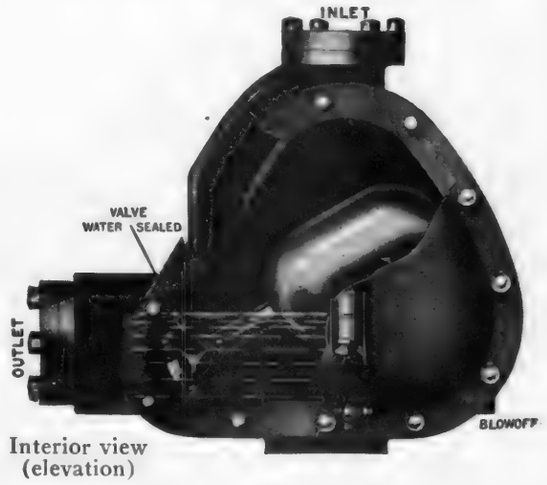
New York, N. Y.



Pump and Lift Trap

COCHRANE
DRAINERS



Interior view
(elevation)

A Drainer That Can Drain

THE Cochrane Multiport is a drainer which really can drain.

The Cochrane No. 5, for example, for 3, 4 and 5-in. pipe, has a capacity of 250,000 lbs. per hour under 10 lbs. pressure differential, the capacity varying as the square root of the differential. Under 2 lbs. differential, the capacity is 112,000 lbs. per hour while under 50 lbs. differential it is 560,000 lbs. per hour.

Even the smallest Cochrane Drainer, the No 1 as used with ½, ¾, 1 and 1¼-in. pipes, has a capacity of 11,500 lbs. per hour under a differential of 10 lbs.

We have such confidence in Cochrane Drainers and we are so desirous that well-known and reliable steam users should avail themselves of this new and improved appliance that we are willing to send one, two or three drainers of whatever size will suit the requirements and to give the user ninety days after shipment in which to satisfy himself that they will perform the duties that we claim. The purchaser will not be bothered with a bill for these drainers, as none will be sent 'til the end of the trial period, at which time he can send us his check with a letter telling us how well pleased he is with the drainer, or should, perchance, the drainer not be adapted to his requirements or prove unsatisfactory in any respect, all he has to do is to return it, freight prepaid.

In ordering, please specify approximately the working pressure on drainer, as well as maximum amount of water to be handled. The Cochrane Drainers are made for ½, ¾, 1, 1¼, 1½, 2, 2½, 3, 4 and 5 in. pipes and for pressures from 1 lb. to 50 lbs. per sq. in. gage. Ask for Publication Q.

"TO ECONOMIZE—COCHRANIZE"

COCHRANE CORPORATION

Formerly Harrison Safety Boiler Works

3118 North 17th St., Philadelphia, Pa.

Offices at Atlanta, Baltimore, Birmingham, Boston, Charlotte, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, El Paso, Hazelton, Pa., Houston, Indianapolis, Kansas City, Little Rock, Los Angeles, Memphis, Minneapolis, New Orleans, New York, Omaha, Phoenix, Pittsburgh, Portland, Richmond, Rochester, St. Louis, Salt Lake City, San Antonio, San Francisco, Seattle, Syracuse, Washington, D. C., Toronto, Montreal, Halifax, Vancouver, London. 213

Long live the piping

Eliminate the destructive agent in the water

Pipe passing raw natural water is subject to a constant attack. Free oxygen, which is dissolved in all natural water constantly tends to unite with the pipe metal to cause oxidation or rust. It sooner or later weakens and destroys the pipe, whether of ferrous or non-ferrous material.

It recently has been discovered that the removal of this dissolved oxygen from the water definitely eliminates the corrosion of pipes. ***Deaerated water*** will protect any kind of piping, allowing it to live out a useful life as long as the building, itself.

Ask for the details.

ELLIOTT COMPANY

Pittsburgh, Pa.

General Sales Office: Fourth Street

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District Offices: New York, Chicago, Philadelphia, Boston, Cleveland, Cincinnati, Detroit, St. Louis, Kansas City, Pittsburgh, Syracuse, Atlanta, Baltimore

N-825

De-aerated Water Prevents Corrosion in Piping

Elliott De-aer-ator

Constant Air Flow

IT IS IMPOSSIBLE TO METER OZONE ELECTRICALLY UNLESS THE AIR FLOW THROUGH THE OZONIZER IS CONSTANT.

The *friction head* of the ozone distributing system *will never be the same on two installations.*

U. S. Ozonizers are equipped with an *accurate flow gage* of the differential pressure type, and the *blowers capacity permits* of *proper regulation* under *all conditions of wear* and *service.*

We maintain our own Research Laboratories and Engineering Staff. Technical publications on OZONE sent on request.

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General Sales Agents for
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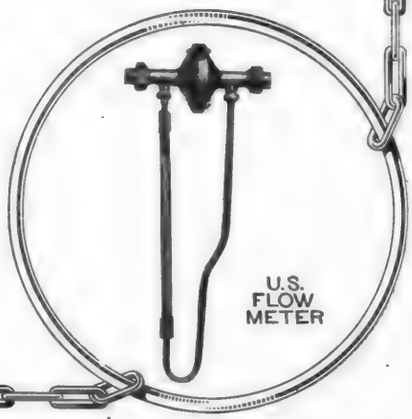
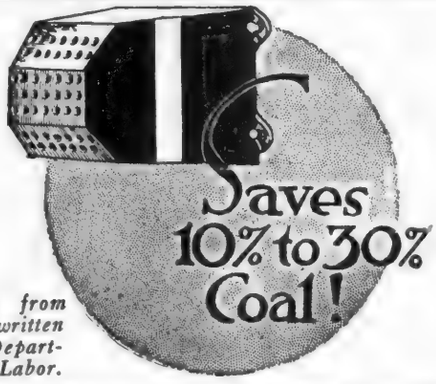




Excerpt from letter written by the Department of Labor.

"Without any consideration of the economy in fuel effected as indicated in the test (35½%) it has been a satisfaction to note the material increase which has been made possible in the period between firings. The fuel has been more completely consumed and there has been a substantial elimination of clinker, all of which has materially reduced the labor necessary to operate the boilers."—Signed Edward Flagg, Chief Engineer, U. S. Department of Labor, Washington, D. C.

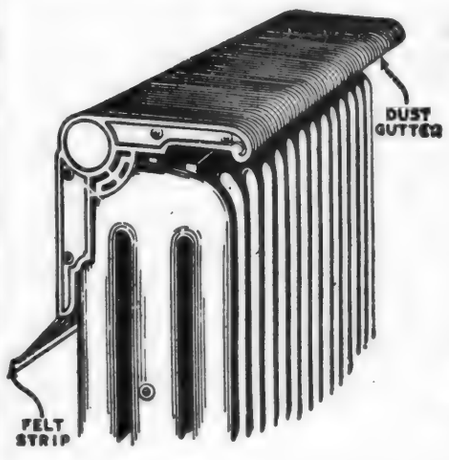
Combusto equipped—the heating plants you sell will render greater service and efficiency than those of your competitors by reducing ash, clinkers and soot, by eliminating coal gas and by maintaining an even flow of heat with fewer number of firings. Moreover you can unconditionally guarantee a fuel economy of 10% to 30%.

Heating contractors of high standing are invited to communicate with us for the distributor rights in their territory.

COMBUSTION SPECIALTIES CORP.
51 WEST 54th STREET NEW YORK CITY

DRAFT COMBUSTO SYSTEM
REG. U.S. PAT. OFF

ACME RADIATOR SHIELDS



are a necessity in every home or building.

All Metal Design

Protection to walls and draperies is guaranteed

ACME shields are neat in appearance, strong and durable.

The price is right. Shipments are prompt.

Live aggressive agents are wanted.

Write for Particulars

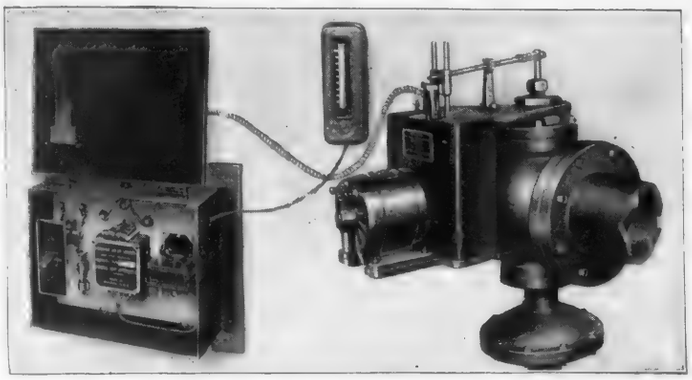
ACME RADIATOR SHIELD COMPANY
320 Central Office Building Cincinnati, Ohio

"Master Control" Saves Central Stations 35% to 60%

Read the following excerpts from an article by Mr. Woodworth in The Heating and Ventilating Magazine for September, 1924.

—H. A. Woodworth

"To reach the most practical conclusions as to economy gained by automatic pressure temperature control, the writer made a series of tests, and the results showed savings of from 35% to 60%."



Hornung's "Master Control" Valve

"'Master Control' does not interfere with individual control of rooms or radiators. It means that radiation can and should be cut off 65% of the time when the outside temperature is 40°, the average temperature of our heating season. It means that the central station and the customer will benefit equally by controlling the heat down to actual requirements.

"The writer recommends that all heating companies stress the automatic temperature control, and thereby slow down the customers' meters at night and on mild days. The waste heat which they are selling to a dissatisfied customer at their lowest rate, could be sold to a new customer at a higher rate, thereby making two satisfied customers."

"'Master Control' is particularly well adapted to Central Station heating, as it requires no attention at any time, being electrically controlled. Many of the central heating companies throughout the country are using this type of control, and recommending it to their customers. The cost of maintenance is negligible."

Central Heat Appliances *J. C. HORNUNG Engineer* **343 S. Dearborn St., Chicago**

NO! This temperature regulator is NOT self-contained!

All metal. No volatile fluids Responds instantly. Sensitive. Durable. Any temperature Will operate any size steam valve at any pressure. Highest quality, yet low price

ATLAS VALVE COMPANY
REGULATING VALVES FOR EVERY SERVICE
281 South St., Newark, N. J.

Adsco Graduated Packless Radiator Valve

Adsco Heating Saves 15% to 25% Fuel Cost

Write for Folder A53-H

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GENERAL OFFICES AND WORKS
NORTH TONAWANDA, N.Y.
Offices:
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MEMBERS THE NATIONAL TRADE ORGANIZATION PLUMBING AND HEATING INDUSTRY

ADSCO HEATING

An economy often overlooked

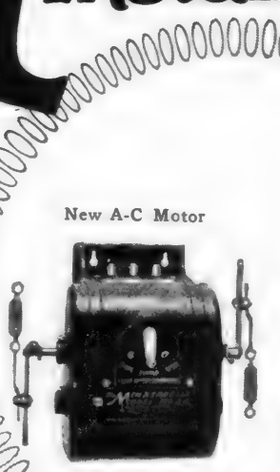
WHEN you regard each pound of steam surging through the pipes as so many cents' worth of coal and men's time the savings brought by cutting unnecessarily high steam pressures to the economical level where they belong is brought home forcibly.

The free catalog goes into the details. Where shall we send yours? Address the G. M. Davis Regulator Co., at 436 Milwaukee Ave., Chicago.

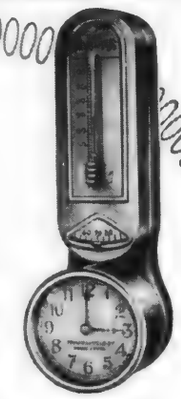
DAVIS VALVE SPECIALTIES
STEAM SAVERS SINCE 1875

HV-12F-RTG

for the next Installation



New A-C Motor



New Model 77 8-day Thermostat with 7-Jewel Clock.

The new super-service heat control equipment

Here's the new heat control equipment that is attracting wide attention among heating engineers. A wonderfully efficient 8-day thermostat with all the simplicity of the 1-day. Equipped with a 7-jewel clock that has proved its merit through long demonstration service.

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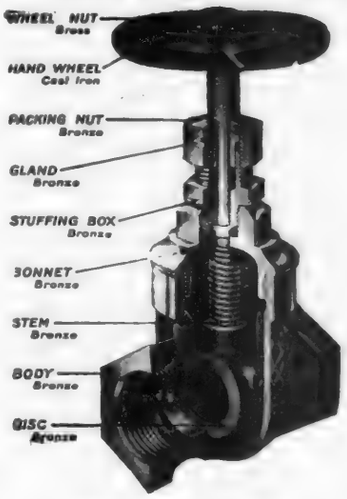

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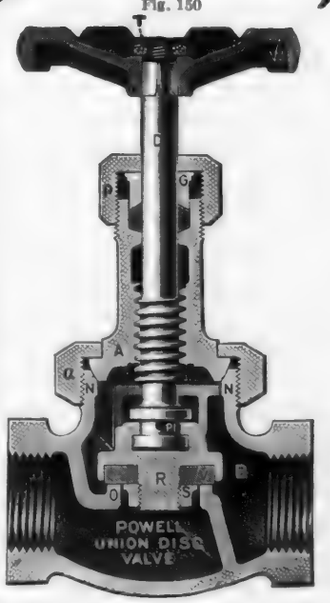

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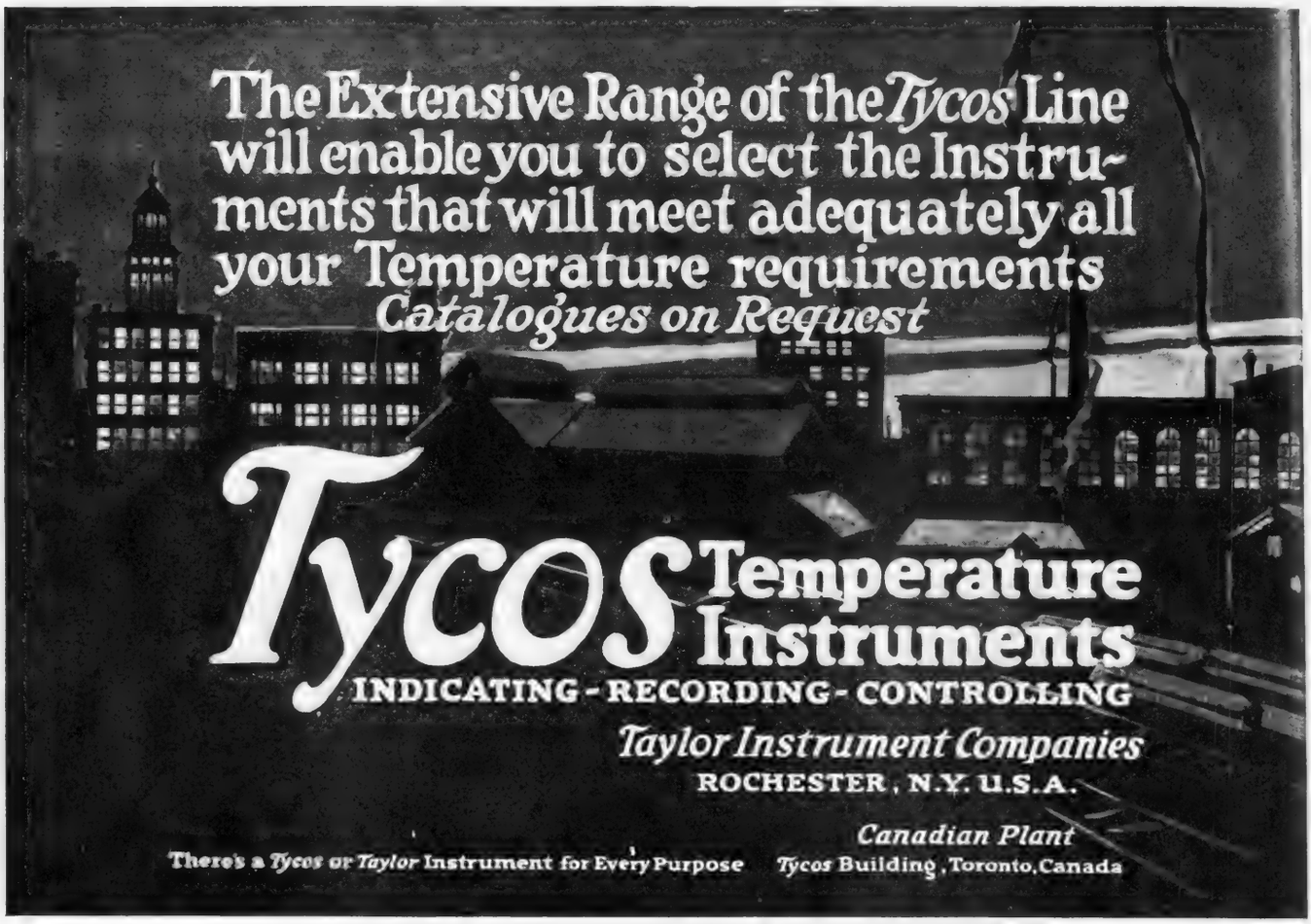
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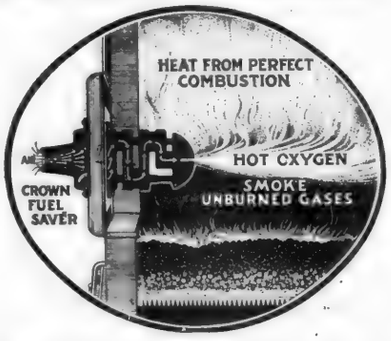

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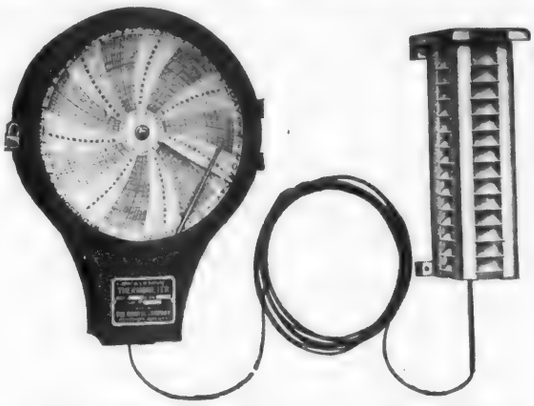

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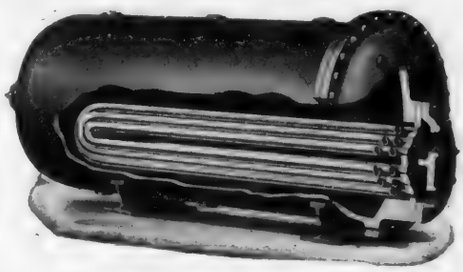

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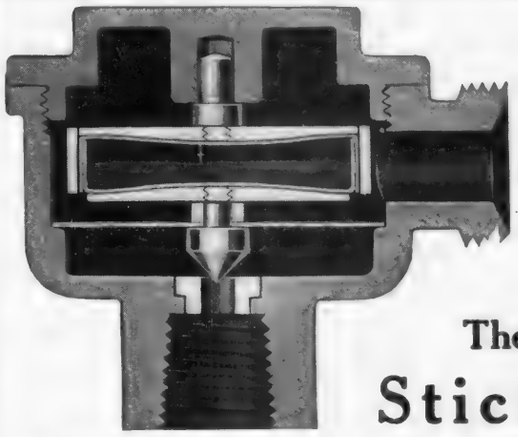

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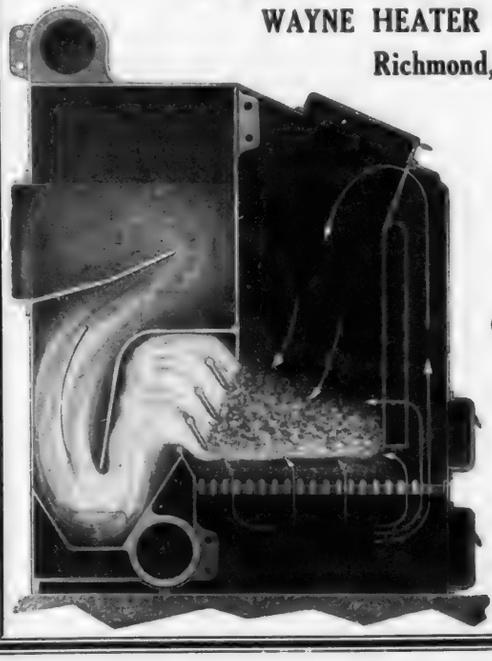

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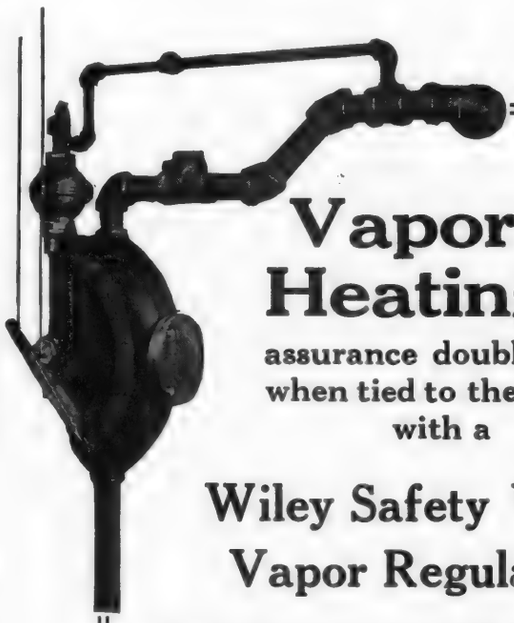

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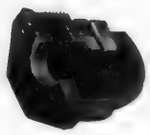

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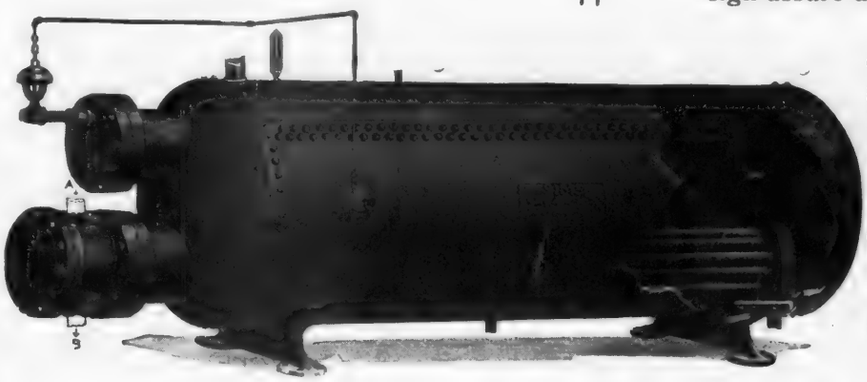

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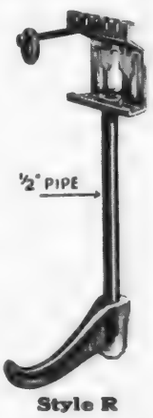

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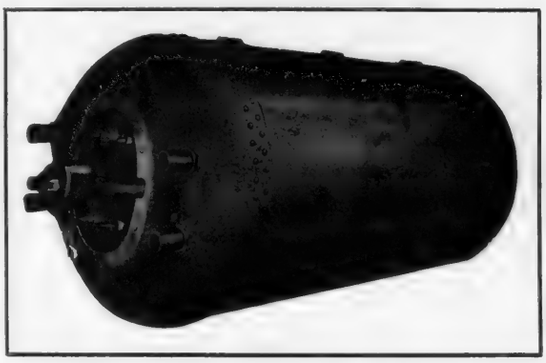

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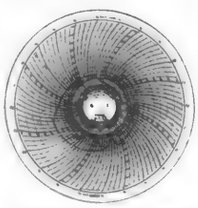

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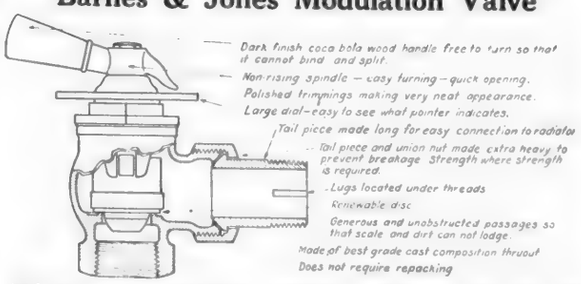
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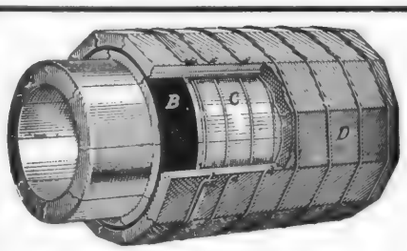

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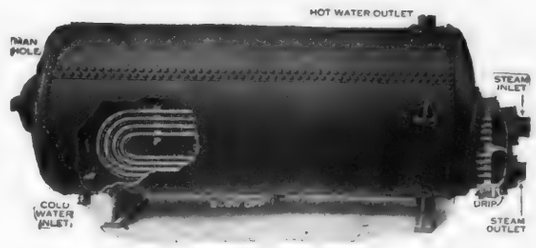

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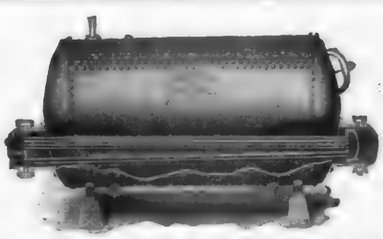


Alberger-Buffalo Storage Heaters have tubes the full length of tank which insures maximum heat transfer. Satisfaction guaranteed. Write for information on Alberger Multi Head Heaters and Howard Guided Expansion Joints.

ALBERGER HEATER COMPANY
HOWARD IRON WORKS
281-289 Chicago St. **Buffalo, N. Y.**

A Combination Heater

With Combination Advantages

The Instanta Storage Heater

(PATENTED)

Advantages:

1. Instantaneous heating when required.
2. Tremendous overload capacity.
3. Storage of hot water against sudden draws.
4. Floating head construction—no strains.
5. Any tube replaced easily without disturbing others.
6. Less space and less piping than an instantaneous heater and separate storage tank.

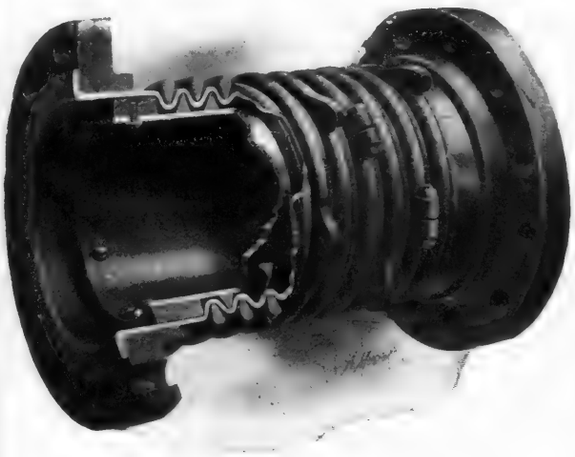
Write for full information

THE GRISCOM-RUSSELL COMPANY
2155 West Street Building
NEW YORK

When You Buy a

WAINWRIGHT EXPANSION JOINT

You Buy REAL FLEXIBILITY



Wainwright Improved Expansion Joint

Multi-corrugations make this possible. By having same thickness of copper throughout the joint and a number of corrugations the WAINWRIGHT EXPANSION JOINTS give greater flexibility and longer life as the movement per corrugation is small.

WAINWRIGHT EXPANSION JOINTS are made especially for use between condensers and turbines and also the improved type with equalizing rings and smooth inner sleeve for pressures up to 150 pounds per square inch.

High grade materials and expert workmanship produce the WAINWRIGHT EXPANSION JOINT to serve you best. Let us know your requirements.

WHEELER CONDENSER & ENGINEERING CO.

149 Broadway, New York

Works - CARTERET, N.J., NEWBURGH, N.Y.

Reg. U. S. Patent Office

SHUR-TITE

IT
NEVER
FAILS

Guarantees a Tight Job

Pour it in the boiler and start the fire.

Stops all leaks while tests are being made.

Shur-Tite Boiler Cement is a Powder —100% efficient—No waste.

Use it on both new and repair jobs. Liberal trade discounts.

The Shur-Tite Mfg. Co.

1912 Cleneay Ave., Norwood, Ohio

CENTRAL STATION STEAM CO.

2912 East Woodbridge St.

DETROIT, MICHIGAN

MANUFACTURERS OF

Cadillac Condensation Meters
Detroit Feed Water Meters

Packingless Expansion Joints and other special fittings for underground steam distribution mains.

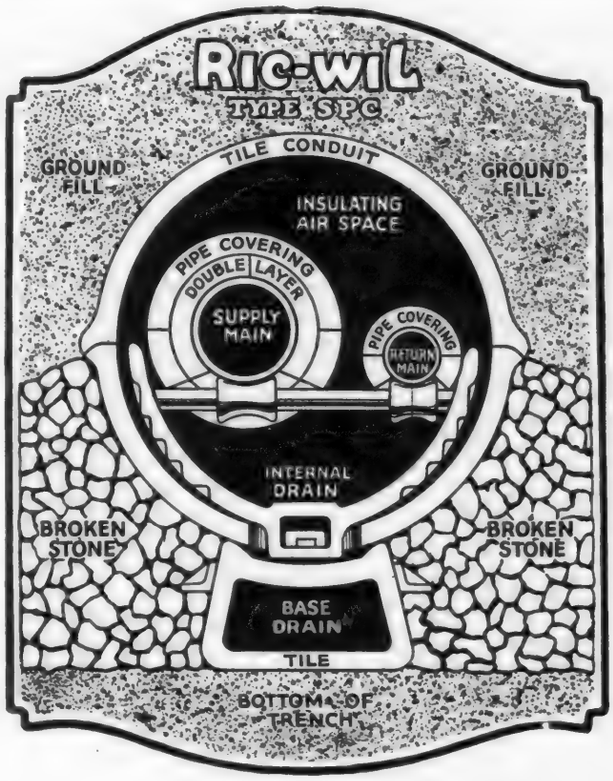
ROSS

Crosshead-GUIDED Expansion Joint Excels in

Design, Construction and Workmanship
Over 60% of sales—Repeat Orders
Once Used—Always Demanded
Every Purchaser—A Customer

ROSS HEATER & MFG. CO., INC., BUFFALO, N. Y.

New York, Chicago, Philadelphia, Boston, Cleveland, St. Louis, Detroit, Pittsburgh, Baltimore, San Francisco, Seattle, Denver, Salt Lake City, Omaha, Montreal, Toronto.



Controlled Practical Efficiency

WITH RIC-WIL Underground Conduit Type SPC, as shown above, you can secure any desired thermal efficiency. For you may specify pipe covering of any quality the market affords. RIC-WIL assures its maximum efficiency.

This type of RIC-WIL permits scientific insulation. The pipe covering may be applied in exactly the proper thickness. Observe the illustration. The pipe that requires the greatest protection gets it.

RIC-WIL adds to this an insulating air space, and both internal and external drainage, insuring dry insulation in a dry conduit, an important advantage in wet ground conditions.

Thousands of installations are proof of the actual high efficiency of RIC-WIL

THE RIC-WIL COMPANY 1570 UNION TRUST BUILDING CLEVELAND, OHIO

RIC WIL

UNDERGROUND CONDUIT

ENGINEERS' SPECIFICATION INDEX

AIR COMPRESSORS.

Nash Engineering Co., So. Norwalk, Conn.

AIR CONDITIONING APPARATUS.

Air Conditioning & Engineering Co., St. Louis, Mo.
American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corporation, Philadelphia, Pa.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, O.
Carrier Air Conditioning Co., of America, Buffalo, N. Y.
Carrier Engineering Corporation, Newark, N. J.
Clarage Fan Co., Kalamazoo, Mich.
Fleisher Co., Inc., W. L. New York.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
Midwest Air Filters, Inc., New York.
New York Blower Co., Chicago, Ill.
Reed Air Filter Co., Inc., Louisville, Ky.
Sturtevant Co., B. F., Hyde Park, Mass.
L. J. Wing Mfg. Co., New York.

AIR COOLING AND DRYING SYSTEMS.

Aerofin Corp., Newark, N. J.
Atmospheric Conditioning Corp., Phila., Pa.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corporation, Newark, N. J.
Clarage Fan Co., Kalamazoo, Mich.
Cooling Tower, Inc., New York.
Fleisher Co., Inc., W. L. New York.
Hersh Bros. Co., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
Midwest Air Fifters, Inc., New York.
New York Blower Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Mass.
L. J. Wing Mfg. Co., New York.

AIR ELIMINATORS.

Jas. P. Marsh & Co., Chicago, Ill.
O-E Specialty Mfg. Co., Milwaukee, Wis.
Midwest Air Filters, Inc., New York.

AIR FILTERS.

Midwest Air Filters, Inc., New York.
Reed Air Filter Co., Inc., Louisville, Ky.

AIR SEPARATORS.

Griscom-Russell Co., New York.
Hoffman Specialty Co., New York.

AIR WASHERS.

American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corp., Phila., Pa.
Badger & Sons Co., E. B., Boston, Mass.
Bayley Mfg. Co., Milwaukee, Wis.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corp., Newark, N. J.
Clarage Fan Co., Kalamazoo, Mich.
Cooling Tower Co., Inc., New York.
Fleisher Co., Inc., W. L. New York.
Hersh Bros. Co., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Reed Air Filter Co., Inc., Louisville, Ky.
Sturtevant Co., B. F., Hyde Park, Mass.

BLOWERS.

Fan.

American Blower Co., Detroit, Mich.
Autovent Fan & Blower Co., Chicago, Ill.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Hersh Bros. Co., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Mass.
L. J. Wing Mfg. Co., New York.
Yarwood Blower Wks., Niagara Falls, N. Y.

Pressure.

American Blower Co., Detroit, Mich.
Autovent Fan & Blower Co., Chicago, Ill.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Hersh Bros. Co., Allentown, Pa.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Mass.
L. J. Wing Mfg. Co., New York.

Rotary.

Sturtevant Co., B. F., Hyde Park, Mass.
L. J. Wing Mfg. Co., New York.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

Turbine.

Sturtevant Co., B. F., Hyde Park, Mass.
L. J. Wing Mfg. Co., New York.

BOILER CEMENT.

Johns-Manville, Inc., New York.
Shor-Tite Mfg. Co., Norwood, Cincinnati, O.

BOILERS.

Down-Draft.

American Radiator Co., Chicago, Ill.
Brownell Co., The, Dayton, O.
General Boilers Co., Waukegan, Ill.
Hart and Crouse, Utica, N. Y.
Illinois Malleable Iron Co., Chicago, Ill.
Kewanee Boiler Co., Kewanee, Ill.
Molby Boiler Co., New York.
Oil City Boiler Works, Oil City, Pa.
Page Boiler Co., Wm. H., New York.
Pierce, Butler & Pierce Mfg. Co., New York.
Richmond Radiator Co., New York.

Heating.

American Radiator Co., Chicago, Ill.
Brownell Co., The, Dayton, O.
Bryant Heater & Mfg. Co., Cleveland, Ohio.
Continental Heater Corp., Dunkirk, N. Y.
Cox Stove Co., Abram, Philadelphia, Pa.
General Boilers Co., Waukegan, Ill.
Gorton & Lidgerwood Co., New York.
Gurney Heater Mfg. Co., Boston, Mass.
Heggie Simplex Boiler Co., Joliet, Ill.
Illinois Malleable Iron Co., Chicago, Ill.
International Heater Co., Utica, N. Y.
Kewanee Boiler Co., Kewanee, Ill.
Molby Boiler Co., New York.
Newport Boiler Co., Chicago, Ill.
Oil City Boiler Works, Oil City, Pa.
Page Boiler Co., Wm. H., New York.
Pierce, Butler & Pierce Mfg. Co., New York.
Richmond Radiator Co., New York.
Thatcher Furnace Co., Newark, N. J.
Titusville Iron Works, Titusville, Pa.
Utica Heater Co., Utica, N. Y.
Wayne Heater Corp, Richmond, Ind.
Weil-McLain Co., Chicago, Ill.

Power.

Heggie Simplex Boiler Co., Joliet, Ill.
Kewanee Boiler Co., Kewanee, Ill.
Oil City Boiler Works, Oil City, Pa.
Titusville Iron Works Co., Titusville, Pa.

CALORIMETERS.

American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Sarco Co., New York.

COILS, PIPE.

American Blower Co., Detroit, Mich.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, N. Y.
Simmons Co., John, New York.

Air.

New York Blower Co., Chicago, Ill.

CONDENSERS.

Alberger Heater Co., Buffalo, N. Y.
American Radiator Co., Chicago, Ill.
American Steam Pump Co., Battle Creek, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Elliott Co., Jeanette, Pa.
Griscom-Russell Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Wheeler Condenser & Engineering Co., Carteret, N. J.
Whitlock Coil Pipe Co., Hartford, Conn.

CONVERTERS, HOT WATER.

Alberger Heater Co., Buffalo, N. Y.
Griscom-Russell Co., New York.
Patterson-Kelley Co., New York.
Ross Heater & Mfg. Co. Inc., Buffalo, N. Y.
Whitlock Coil Pipe Co., Hartford, Conn.
Wyckoff & Son Co., A., Elmira, N. Y.

COOLERS.

Oil.

Alberger Heater Co., Buffalo, N. Y.
Griscom-Russell Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Whitlock Coil Pipe Co., Hartford, Conn.

COOLING TOWERS.

Badger & Sons Co., E. B., Boston, Mass.
Cooling Tower Co., Inc., New York.

COPPER BOILERS

Dahlquist Mfg. Co., Boston, Mass.

COPPER KETTLES

Dahlquist Mfg. Co., Boston, Mass.

COVERING, PIPE.

American District Steam Co., No. Tonawanda, N. Y.
Hornung, J. C., Chicago, Ill.
Johns-Manville Inc., New York.
Ric-Wil Co., Cleveland, O.
Wyckoff & Son Co., A., Elmira, N. Y.

DAMPERS, DUCT.

American Blower Co., Detroit, Mich.
Buckeye Blower Co., Columbus, O.

DEHUMIDIFYING APPARATUS.

American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corp., Phila., Pa.
Bayley Mfg. Co., Milwaukee, Wis.
Carrier Engineering Corp., Newark, N. J.
Cooling Tower Co., Inc., New York.
Fleisher Co., Inc., W. L., New York.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Mass.

DISTILLERS, (Water).

Badger & Sons Co., E. B., Boston, Mass.
Griscom-Russell Co., New York.
Ross Heater & Mfg. Co. Inc., Buffalo, N. Y.

DRAFT APPLIANCES.

Combustion Specialties, New York.
Crown Fuel Saver Co., Richmond, Ind.
Wolff Coal Saver Co., Chicago, Ill.

DRYING SYSTEMS.

(See Air Cooling and Drying Systems.)

DUST COLLECTING SYSTEMS.

American Blower Co., Detroit, Mich.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, New York.
Clarage Fan Co., Kalamazoo, Mich.
Hersh Brothers Co., Allentown, Pa.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Mass.

DUST COLLECTORS.

American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corp., Phila., Pa.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Co., Newark, N. J.
Clarage Fan Co., Kalamazoo, Mich.
Hersh Brothers Co., Allentown, Pa.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Mass.

DUST DETERMINATORS.

Atmospheric Conditioning Corp., Phila., Pa.
Hill, E. Vernon Co., Chicago, Ill.

ENGINES.

Steam, Automatic.

American Blower Co., Detroit, Mich.
Brownell Co., The, Dayton, O.
Clarage Fan Co., Kalamazoo, Mich.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Mass.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

Steam, High Speed.

American Blower Co., Detroit, Mich.
Brownell Co., The, Dayton, O.
Clarage Fan Co., Kalamazoo, Mich.
New York Blower Co., Chicago, Ill.
Pierce, Butler & Pierce Mfg. Co., New York.
Sturtevant Co., B. F., Hyde Park, Mass.

EQUALIZING LOOPS.

Hoffman Specialty Co., New York.

EVAPORATORS.

Boiler Feed Make-Up.

Badger & Sons Co., E. B., Boston, Mass.
Griscom-Russell Co., New York.
Ross Heater & Mfg. Co., Inc. Buffalo, N. Y.
Whitlock Coil Pipe Co., Hartford, Conn.

EXHAUST SYSTEMS.

American Blower Co., Detroit, Mich.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, N. Y.
Ilg Electric Ventilating Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Mass.
Wing Mfg. Co., L. J., New York.

EXHAUST HEADS.

Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Patterson-Kelley Co., New York.
Simmons Co., John, New York.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Mass.
Wright-Austin Co., Detroit, Mich.

"The Line of Least Resistance"

—and Fewest Leaks

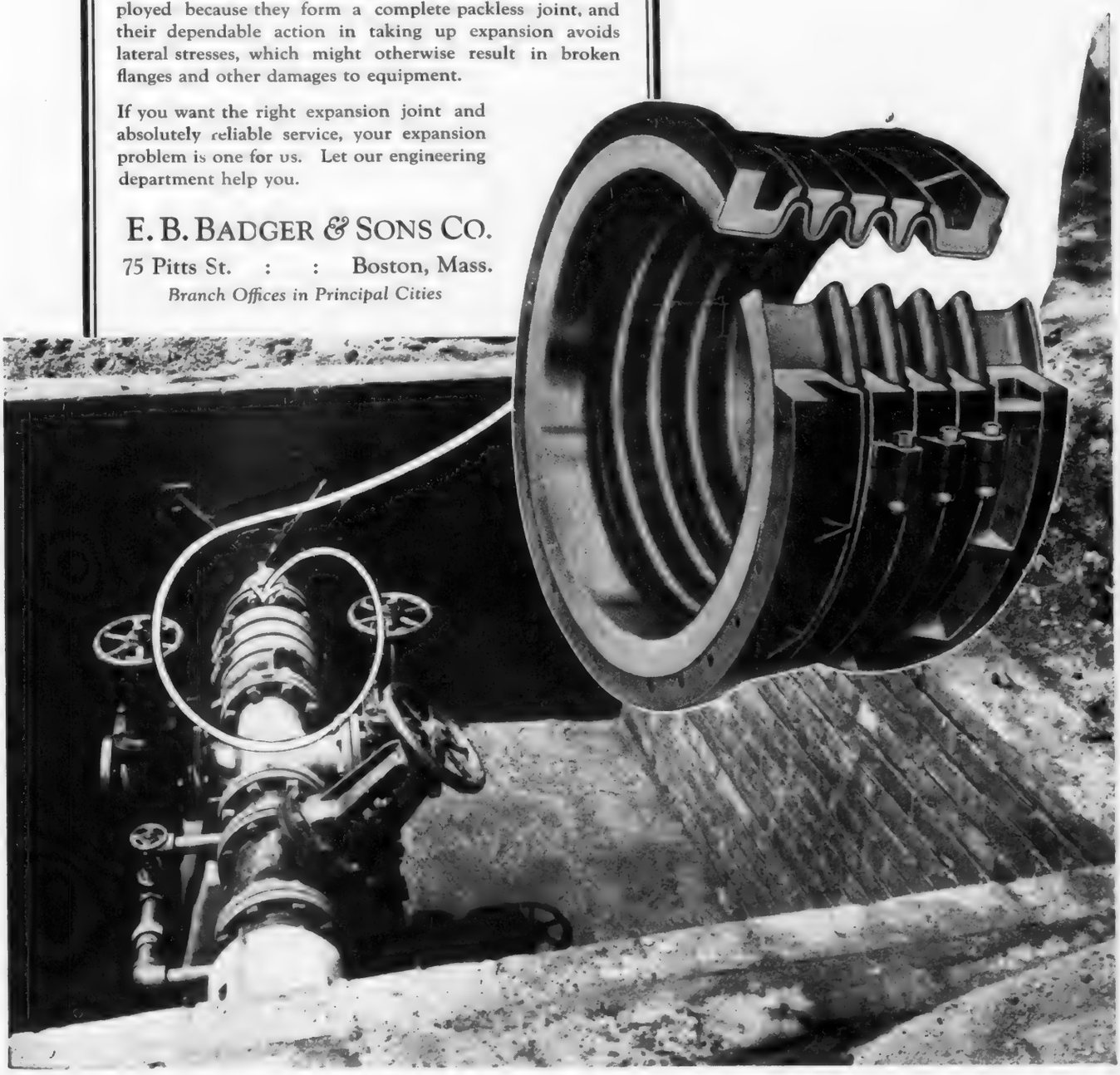
is the pipe line that is equipped with **Badger Self-Equalizing Expansion Joints**, which take up automatically the expansion in pipe lines.

Minimum resistance is accomplished by the particular construction of **Badger Expansion Joints.** The one-piece, seamless copper expansion element, with corrugations of proper depth, take up all expansion strain without resistance. The expansion rings distribute the expansion equally over the corrugations and at the same time add strength to the copper.

There are no leaks where **Badger Expansion Joints** are employed because they form a complete packless joint, and their dependable action in taking up expansion avoids lateral stresses, which might otherwise result in broken flanges and other damages to equipment.

If you want the right expansion joint and absolutely reliable service, your expansion problem is one for us. Let our engineering department help you.

E. B. BADGER & SONS CO.
75 Pitts St. : : Boston, Mass.
Branch Offices in Principal Cities



ENGINEERS' SPECIFICATION INDEX (Continued)

EXPANSION JOINTS.

American District Steam Co., No. Tonawanda, N. Y.
Badger & Sons Co., E. B., Boston, Mass.
Central Station Steam Co., Detroit, Mich.
Crane Co., Chicago, Ill.
Dahlquist Mfg. Co., Boston, Mass.
Griscom-Russell Co., New York.
Hornung, J. C., Chicago, Ill.
Howard Iron Works, Buffalo, N. Y.
Illinois Engineering Co., Chicago, Ill.
Ric-Wil Co., Cleveland, O.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Webster & Co., Warren, Camden, N. J.
Wheeler Condenser & Engineering Co., Carteret, N. J.

FANS, EXHAUST.

American Blower Co., Detroit, Mich.
Autovent Fan & Blower Co., Chicago, Ill.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Hersh Bros. Co., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Mass.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
L. J. Wing Mfg. Co., New York.

FILTERS, (Aerating).

Cochrane Corp., Philadelphia, Pa.
Griscom-Russell Co., New York.

Feed-Water.

Elliott Co., Jeanette, Pa.
Griscom-Russell Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.

FITTINGS, FLANGED.

American District Steam Co., No. Tonawanda, N. Y.
Crane Co., Chicago, Ill.
Simmons Co., John, New York.

FLANGES.

American District Steam Co., No. Tonawanda, N. Y.
Crane Co., Chicago, Ill.
Jenkins Bros., New York.

FLOOR SLEEVES.

Delbrook Ventilating Co., Boston, Mass.
Farley Sleeve & Hanger Co., Cleveland, Ohio.

GASKETS, METALLIC.

Sarco Co., New York.

GAUGE BOARDS.

American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Bishop & Babcock Co., Cleveland, Ohio.
Bristol Co., Waterbury, Conn.
Foxboro Co., Inc., The Foxboro, Mass.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Taylor Instrument Cos., Rochester, N. Y.
Webster & Co., Warren, Camden, N. J.

GAUGES.

Altitude.

Pierce, Butler & Pierce Corp., New York.

Draft.

American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Foxboro Co., Inc., The Foxboro, Mass.
Marsh & Co., Jas. P., Chicago, Ill.

Hydraulic.

American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Foxboro Co., Inc., The Foxboro, Mass.
Marsh & Co., Jas. P., Chicago, Ill.

Ounce Graduated.

Marsh & Co., Jas. P., Chicago, Ill.
O-E Specialty Co., Milwaukee, Wis.

Pressure.

American Dist. Steam Co., North Tonawanda, N. Y.
American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Foxboro Co., Inc., The Foxboro, Mass.
Bristol Co., Waterbury, Conn.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
O-E Specialty Mfg. Co., Milwaukee, Wis.
Webster & Co., Warren, Camden, N. J.
Bishop & Babcock Co., Cleveland, Ohio.

Vacuum.

American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Bristol Co., Waterbury, Conn.
Foxboro Co., Inc., The Foxboro, Mass.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Taylor Instrument Cos., Rochester, N. Y.
Webster & Co., Warren, Camden, N. J.

Vacuum (Compound).

Pierce, Butler & Pierce Corp., New York.

Water.

American District Steam Co., No. Tonawanda, N. Y.
American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Bristol Co., Waterbury, Conn.
Bristol Co., Waterbury, Conn.
Jenkins Bros., New York.

GENERATOR COOLING SYSTEMS.

Atmospheric Conditioning Corp., Phila., Pa.
Bayley Mfg. Co., Milwaukee, Wis.
Carrier Air Conditioning Co., of America, Buffalo, N. Y.
Cooling Tower Co., Inc., New York.
Sturtevant Co., B. F., Hyde Park, Mass.

GENERATORS, (Heat.)

Honeywell Heating Specialties Co., Wabash, Ind.

GOVERNORS, (Pump).

Atlas Valve Co., Newark, N. J.
Davis Regulator Co., G. M., Chicago, Ill.
Foster Engineering Co., Newark, N. J.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Mason Regulator Co., Boston, Mass.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Wright-Austin Co., Detroit; Mich.

HEATERS.

Domestic Water.

Alberger Heater Co., Buffalo, N. Y.
American District Steam Co., No. Tonawanda, N. Y.
American Radiator Co., Chicago, Ill.
Bryant Heater & Mfg. Co., Cleveland, Ohio.
Dahlquist Mfg. Co., Boston, Mass.
Everhot Heater Co., Detroit, Mich.
Excelso Specialty Works, Buffalo, N. Y.
National Pipe Bending Co., New Haven, Conn.
Page Boiler Co., Wm. H., New York.
Patterson-Kelley Co., New York.
Pierce, Butler & Pierce Corp., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Sims Co., Erie, Pa.
Thermal Appliance Co., New York.
Whitlock Coil Pipe Co., Hartford, Conn.

Feed Water, (Closed).

Alberger Heater Co., Buffalo, N. Y.
Griscom-Russell Co., New York.
King Construction Co., North Tonawanda, N. Y.
McAlear Mfg. Co., Chicago, Ill.
Patterson-Kelley Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Simmons Co., John, New York.
Sims Co., Erie, Pa.
Wheeler Condenser & Engineering Co., Carteret, N. J.
Whitlock Coil Pipe Co., Hartford, Conn.

Feed Water, (Open).

Cochrane Corp., Philadelphia, Pa.
Griscom-Russell Co., New York.
Sims Co., Erie, Pa.
Stickle Steam Specialties Co., Indianapolis, Ind.
Webster & Co., Warren, Camden, N. J.

Fuel-oil.

Alberger Heater Co., Buffalo, N. Y.
American Blower Co., Detroit, Michigan.
Griscom-Russell Co., New York.
Ross Heater & Mfg. Co., Inc. Buffalo, N. Y.
Universal Automatic Oil Burner Corporation, Detroit, Michigan.
Whitlock Coil Pipe Co., Hartford, Conn.

Air, Fan System

Aerofin Corporation, Newark, N. J.
American Blower Co., Detroit, Mich.
American Radiator Co., Chicago, Ill.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Mass.

Portable Unit Air.

American Blower Co., Detroit, Mich.
Autovent Fan & Blower Co., Chicago, Ill.
Buffalo Forge Co., Buffalo, N. Y.
Dwyer Equipment Co., Chicago, Ill.
Ilg Electric Ventilating Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Mass
L. J. Wing Mfg. Co., New York.
(See also Ventilators, Portable Unit.)

HEATING SYSTEMS.

"Gasteam"

James B. Clow & Sons, Chicago, Ill.

Vacuum.

Barnes & Jones, Boston, Mass.
Bishop & Babcock Co., Cleveland, Ohio.
Dunham Co., C. A., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Klipfel Mfg. Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
O-E Specialty Co., Milwaukee, Wis.
Sarco Co., New York.
Sterling Engineering Co., Milwaukee, Wis.
Stickle Steam Specialties Co., Indianapolis, Ind.
Webster & Co., Warren, Camden, N. J.

Vapor.

American District Steam Co., No. Tonawanda, N. Y.
Barnes & Jones, Boston, Mass.
Dunham Co., C. A., Chicago, Ill.
Gold Car Heating & Lighting Co., Brooklyn, N. Y.
Gorton & Lidgerwood Co., New York.
Haines & Co., Wm. S., Philadelphia, Pa.
Ideal Heating Equip. Co., Cleveland, Ohio.
Illinois Engineering Co., Chicago, Ill.
Illinois Malleable Iron Co., Chicago, Ill
Klipfel Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Mouat Vapor Heating Co., Cleveland, O.
H. W. Nelson Co., Moline, Ill.
O-E Specialty Mfg. Co., Milwaukee, Wis.
Sarco Co., New York.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Sterling Engineering Co., Milwaukee, Wis.
Trane & Co., La Crosse, Wis.
Webster & Co., Warren, Camden, N. J.

Water.

Cochrane Corp., Philadelphia, Pa.

HUMIDIFIERS.

American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corp., Phila., Pa.
Bayley Mfg. Co., Milwaukee, Wis.
Carrier Air Conditioning Co., of America, Buffalo, N. Y.
Carrier Engineering Corporation, Newark, N. J.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Mass.

HUMIDITY CONTROL.

American Blower Co., Detroit, Mich.
Atlas Valve Co., Newark, N. J.
Atmospheric Conditioning Corp., Phila., Pa.
Bayley Mfg. Co., Milwaukee, Wis.
Carrier Air Conditioning Co., of America, Buffalo, N. Y.
Carrier Engineering Corp., Newark, N. J.
Foxboro Co., Inc., The Foxboro, Mass.
Klipfel Mfg. Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Mass.

INSTRUMENTS.

Electric Measuring.

Bristol Co., Waterbury, Conn.
Taylor Instrument Cos., Rochester, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Indicating and Recording.

American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Bristol Co., Waterbury, Conn.
Bailey Meter Co., Cleveland, O.
Cochrane Corp., Philadelphia, Pa.
Foxboro Co., Inc., The Foxboro, Mass.
Hill, E. Vernon Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Sarco Co., New York.
Taylor Instrument Cos., Rochester, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

INSULATING MATERIALS.

American District Steam Co., No. Tonawanda, N. Y.
Hornung, J. C., Chicago, Ill.
Johns-Manville, Inc., New York.
Ric-Wil Co., Cleveland, O.
Union Fibre Co., Winona, Minn.
Wyckoff & Sons, A., Elmira, N. Y.

MANOMETERS.

American Schaeffer & Budenberg Corp., Brooklyn, N. Y.

MECHANICAL DRAFT APPARATUS.

American Blower Co., Detroit, Mich.
Buckeye Blower Co., Columbus, O.
Clarage Fan Co., Kalamazoo, Mich.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Mass.
L. J. Wing Co., New York.

METERS.

Condensation.

American Dist. Steam Co., No. Tonawanda, N. Y.
Central Station Steam Co., Detroit, Mich.
Hornung, J. C., Chicago, Ill.

Feed Water.

Central Station Steam Co., Detroit, Mich.
Simmons Co., John, 110 Center St., New York.

Feed Water (Weir Type).

Cochrane Corp. Philadelphia, Pa.
Webster & Co. Warren, Camden, N. J.

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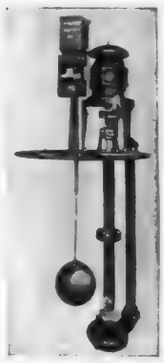

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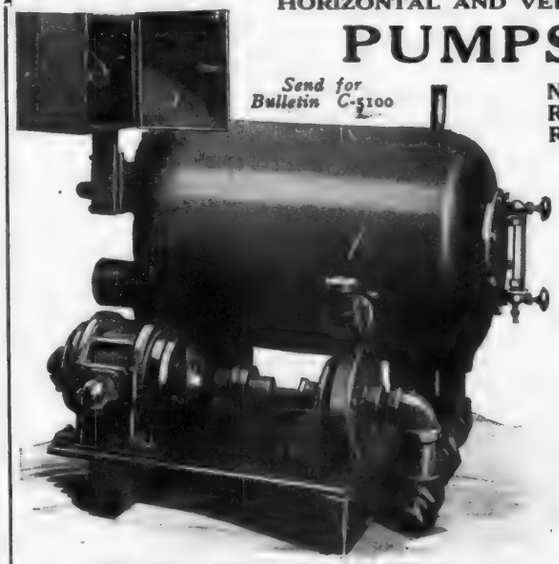

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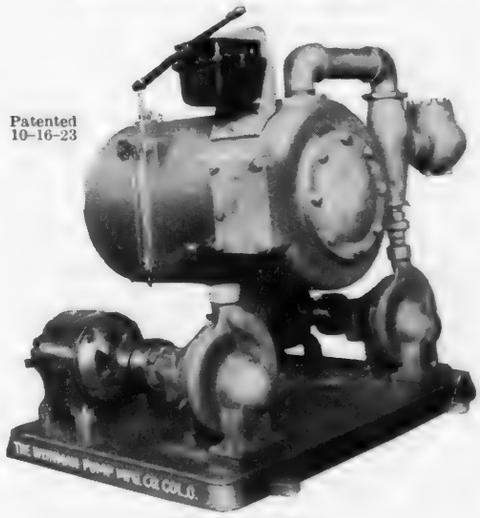

FIGURE NO. 525

THE WEINMAN PUMP MFG. CO.
Columbus, Ohio

ENGINEERS' SPECIFICATION INDEX (Continued)

METERS—(Cont'd)

Pitot Tube.
American Blower Co., Detroit, Mich.

Steam.
American District Steam Co., No. Tonawanda, N. Y.
Cochrane Corp., Philadelphia, Pa.
Foxboro Co., Inc., The Foxboro, Mass.

MOTORS (Electric).
Sturtevant Co., B. F., Hyde Park, Mass.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

OZONE APPARATUS.
Air Conditioning & Engineering Co., St. Louis, Mo.
United States Ozone Co., Scottdale, Pa.

PIPE.

Soil.
Simmons Co., John, 110 Center St., New York.

Steel.
National Tube Co., Pittsburgh, Pa.
Simmons Co., John, 110 Center St., New York.

Wrought Iron.
National Tube Co., Pittsburgh, Pa.
Simmons Co., John, 110 Center St. New York.

Wood.
Wyckoff & Sons Co., A., Elmira, N. Y.

PIPE BENDING.
Badger & Sons Co., E. B., Boston, Mass.
Buffalo Forge Co., Buffalo, N. Y.
Crane Co., Chicago, Ill.
National Pipe Bending Co., New Haven, Conn.
Simmons Co., John, 110 Center St., New York.
Whitlock Coil Pipe Co., Hartford, Conn.

PIPE CASING, (Wood).
American District Steam Co., No. Tonawanda. N. Y.
Wyckoff & Sons Co., A., Elmira, N. Y.

PIPE HANGERS.
Jenkins Bros., New York.
Simmons Co., John, New York.

PIPE CUTTING AND THREADING MACHINES.
Crane Co., Chicago, Ill.

PIPE, POWER.
Crane Co., Chicago, Ill.
Simmons Co., John, New York.

PUMPS.

Centrifugal.
American Steam Pump Co., Battle Creek, Mich.
Buffalo Steam Pump Co., Buffalo, N. Y.
Chicago Pump Co., Chicago, Ill.
Nash Engineering Co., So. Norwalk, Conn.
Taylor Machine Works, Battle Creek, Mich.
Westinghouse Elec. & Mfg. Co. East Pittsburgh, Pa.
Weinman Pump Mfg. Co., Columbus, Ohio.
Wheeler Condenser & Engineering Co., Carteret, N. J.
Yeomans Bros. Co., Chicago, Ill.
Young Pump Co., Michigan City, Ind.

Condensation.
American Steam Pump Co., Battle Creek, Mich.
Buffalo Steam Pump Co., Buffalo, N. Y.
Chicago Pump Co., Chicago, Ill.
Weinman Pump Mfg. Co., Columbus, Ohio.
Wright-Austin Co., Detroit, Mich.
Yeomans Bros. Co., Chicago, Ill.
Wright-Austin Co., Detroit, Mich.
Yeomans Bros. Co., Chicago, Ill.

Rotary.
Nash Engineering Co., So. Norwalk, Conn.

Steam.
American Steam Pump Co., battle Creek, Mich.
Buffalo Steam Pump Co., Buffalo, N. Y.
Nash Engineering Co., So. Norwalk, Conn.

Turbine.
Nash Engineering Co., So. Norwalk, Conn.
Weinman Pump Mfg. Co., Columbus, Ohio.
Wheeler Condenser & Engineering Co., Carteret, N. J.
Yoemans Bros., Chicago, Ill.

Vacuum.
American Steam Pump Co., Battle Creek, Mich.
Bishop & Babcock Co., Cleveland, Ohio.
Chicago Pump Co., Chicago, Ill.
Elliott Co., Jeanette, Pa.
McAlear Mfg. Co., Chicago, Ill
Nash Engineering Co., So. Norwalk, Conn.
Ross Heater & Mfg. Co., Inc. Buffalo, N. Y.
Skidmore Corp., Chicago, Ill.
Trane Co., La Crosse, Wis.
Weinman Pump Mfg. Co., Columbus, Ohio.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Yeomans Bros. Chicago, Ill.
Young Pump Co., Michigan City, Ind.

RADIATOR BUSHINGS

Metering
Holley Engineering Co., Virginia, Minn.

RADIATOR COVERS
Acme Radiator Shield Co., Cincinnati, Ohio.
Schleicher, Inc., Chicago, Ill.

RADIATOR HANGERS.
Farley Sleeve & Hanger Co., Cleveland, Ohio.
Gloeckle, Jr., A. F., Rochester, N. Y.
Healy-Ruff Co. Minneapolis, Minn.
Pierce, Butler & Pierce Mfg. Co., New York.

RADIATORS

"Gasteam"
James B. Clow & Sons, Chicago, Ill.

RADIATORS, STEAM AND WATER.
Aerofin Corp., Newark, N. J.
American Radiator Co., Chicago, Ill.
International Heater Co., Utica, N. Y.
Gurney Heater Mfg. Co., Boston, Mass.
Lyon Products Co., Chicago, Ill.
Pierce, Butler & Pierce Mfg. Co., New York.
Richmond Radiator Co., New York.
Simmons Co., John, New York.

RECEIVERS.

Air.
American District Steam Co., No. Tonawanda, N. Y.
The Brownell Co., Dayton, O.
Sterling Engineering Co., Milwaukee, Wis.

Condensation.
Chicago Pump Co., Chicago, Ill.
Davis Regulator Co., G. M., Chicago. Ill.
McAlear Mfg. Co., Chicago, Ill.
Yeomans Bros., Chicago, Ill.

REGULATORS.

Boiler-Feed.
Klipfel Mfg. Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
National Regulator Co., Chicago, Ill.
Wright-Austin Co., Detroit. Mich.

Damper.
American Dist. Steam Co., No. Tonawanda, N. Y.
Atlas Valve Co., Newark, N. J.
American Radiator Co., Chicago, Ill.
Bishop & Babcock Co., Cleveland, Ohio.
Davis Regulator Co., G. M., Chicago, Ill.
Honeywell Heating Specialties Co., Wabash, Ind.
McAlear Mfg. Co., Chicago, Ill.
Mueller Co., Decatur, Ill.
National Regulator Co., Chicago, Ill.
Nelson Co., H. W., Moline, Ill.
O-E Specialty Mfg. Co., Milwaukee, Wis.
Simplex Heating Specialty Co., Inc., Lynchburgh, Va.
Sterling Engineering Co., Milwaukee, Wis.
Stickle Steam Specialties Co., Indianapolis, Ind.
Trane Co., La Crosse, Wis.
L. J. Wing Mfg. Co., New York.

Pressure.
American District Steam Co., No. Tonawanda, N. Y.
Atlas Valve Co., Newark, N. J.
Crane Co., Chicago, Ill.
Davis Regulator Co., G. M., Chicago, Ill.
Foster Engineering Co., Newark, N. J.
Foxboro Co., Inc., The Foxboro, Mass.
Honeywell Heating Specialties Co., Wabash, Ind.
Hornung, J. C., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Klipfel Mfg. Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Minneapolis Heat Regulator Co., Minneapolis, Minn.
National Regulator Co., Chicago, Ill.
Stickle Steam Specialties Co., Indianapolis, Ind.
Taylor Instrument Cos., Rochester, N. Y.

Temperature.
American Radiator Co., Chicago, Ill.
Atlas Valve Co., Newark, N. J.
Bishop & Babcock Co., Cleveland, Ohio.
Carrier Engineering Corporation, Newark, N. J.
Elliott Co., Jeanette, Pa.
Foxboro Co., Inc., The Foxboro, Mass.
Fulton Co., Knoxville, Tenn.
Honeywell Heating Specialties Co., Wabash, Ind.
Hornung, J. C., Chicago, Ill.
Johnson Service Co., Milwaukee, Wis.
Klipfel Mfg. Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Minneapolis Heat Regulator Co., Minneapolis, Minn.
National Regulator Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.
Sarco Co., New York.
Taylor Instrument Cos., Rochester, N. Y.

SEPARATORS.

Oil.
Cochrane Corp., Philadelphia, Pa.
Elliott Co., Jeanette, Pa.
Griscom-Russell Co., New York.
Illinois Engineering Co., Chicago, Ill.
Stickle Steam Specialties Co., Indianapolis, Ind.
Wright-Austin Co., Detroit, Mich.

Steam.
American District Steam Co., No. Tonawanda, N. Y.
Bishop & Babcock Co., Cleveland, Ohio.
Cochrane Corp., Philadelphia, Pa.
Crane Co., Chicago, Ill.
Elliott Co., Jeanette, Pa.
Griscom-Russell Co., New York.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Patterson-Kelley Co., New York.
Sims Co., Erie, Pa.
Stickle Steam Specialties Co., Indianapolis, Ind.
Webster & Co., Warren, Camden, N. J.
Wright-Austin Co., Detroit, Mich.

SPRAY COOLING SYSTEMS.
Atmospheric Conditioning Corp., Phila., Pa.
Bayley Mfg. Co., Milwaukee, Wis.
Cooling Tower Co., Inc., New York.
Massachusetts Blower Co., Watertown, Mass.

STRAINERS.

Oil.
Elliott Co., Jeanette, Pa.
Griscom-Russell Co., New York.
Ross Heater & Mfg. Co., Inc. Buffalo, N. Y

Steam
American Dist. Steam Co., No. Tonawanda N. Y.
Dunham Co., C. A., Chicago, Ill.
Elliott Co., Jeannette, Pa.
Foster Engineering Co., Newark, N. J.
Illinois Engineering Co., Chicago, Ill.
Kieley & Mueller, Inc., New York.
Mason Regulator Co., Boston, Mass.
McAlear Mfg. Co., Chicago, Ill.
Sarco Co., New York.
Sterling Engineering Co., Milwaukee, Wis.
Wright-Austin Co., Detroit, Mich.

Water
American Dist. Steam Co., No. Tonawanda, N. Y.
Davis Regulator Co., G. M., Chicago, Ill.
Foster Engineering Co., Newark, N. J.
Illinois Engineering Co., Chicago, Ill.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Mason Regulator Co., Boston, Mass.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Sarco Co., New York.

THERMOMETERS.
(Recording and Indicating.)
American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Bristol Co., Waterbury, Conn.
Cochrane Corp., Philadelphia, Pa.
Foxboro Co., Inc., The Foxboro, Mass.
Moto Meter Company, Inc., Long Island City, N. Y.
Sarco Co., New York.
Taylor Instrument Cos., Rochester, N. Y.

Water
Marsh & Co., Jas. P., Chicago, Ill.
Pierce, Butler & Pierce Corp., New York.

THERMOSTATS.
American Radiator Co., Chicago, Ill.
Atlas Valve Co., Newark, N. J.
Bishop & Babcock Co., Cleveland, Ohio.
Fulton Co., Knoxville, Tenn.
Honeywell Heating Specialties Co., Wabash, Ind.
Johnson Service Co., Milwaukee, Wis
Klipfel Mfg. Co., Chicago, Ill.
Minneapolis Heat Regulator Co., Minneapolis, Minn.
Powers Regulator Co., Chicago, Ill.
Sarco Co., New York.

TRAPS.

Radiator.
Barnes & Jones, Boston, Mass.
Bishop & Babcock Co., Cleveland, Ohio.
Dole Valve Co., Chicago, Ill.
Dunham, C. A., Co., Chicago, Ill.
Hoffman Specialty Co., New York.
Ideal Heating Equipment Co., Cleveland, Ohio.
Illinois Engineering Co., Chicago, Ill.
Johns-Manville, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Mouat Vapor Heating Co., Cleveland, O.
H. W. Nelson Co., Moline, Ill.
O-E Specialty Mfg. Co., Milwaukee, Wis.
Sarco Co., New York.
Sterling Engineering Co., Milwaukee, Wis.
Stickle Steam Specialties Co., Indianapolis, Ind.
Trane Co., La Crosse, Wis.
Webster & Co., Warren, Camden, N. J.

Return.
American Blower Co., Detroit, Mich.
Barnes & Jones, Boston, Mass.
Dunham Co., C. A., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Johns-Manville, Inc., New York.
Kieley & Mueller, Inc., New York.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Mouat Vapor Heating Co., Cleveland, O.
O-E Specialty Mfg. Co., Milwaukee, Wis.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., La Crosse, Wis.
Webster & Co., Warren, Camden, N. J.
Wright-Austin Co., Detroit, Mich.

Steam.
American Blower Co., Detroit, Mich.
American District Steam Co., No. Tonawanda, N. Y.
American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Barnes & Jones, Boston, Mass.
Crane Co., Chicago, Ill.
Davis Regulator Co., G. M., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Elliott Co., Jeanette, Pa.
Haines & Co., Wm. S., Philadelphia, Pa.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Johns-Manville, Inc., New York.
Klipfel Mfg. Co., Chicago, Ill.

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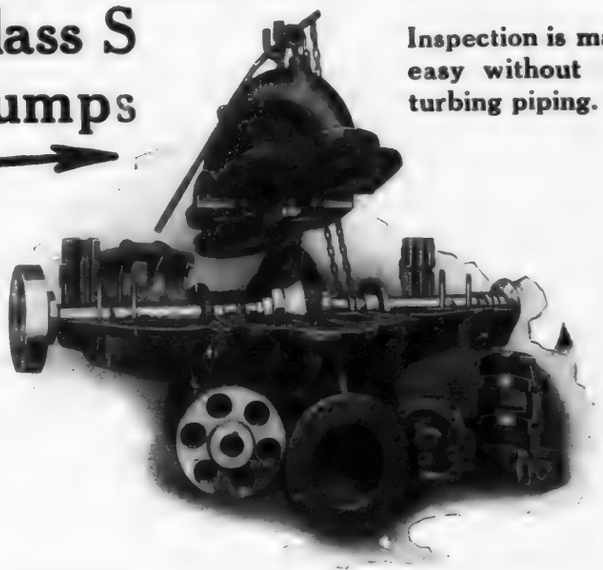

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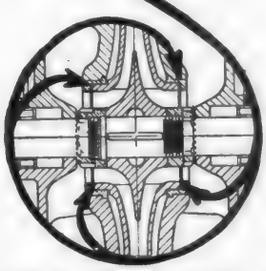

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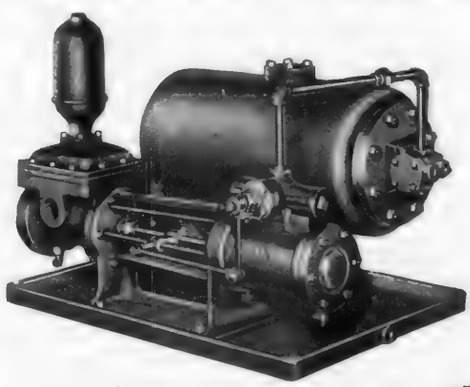

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ENGINEERS' SPECIFICATION INDEX (Continued)

Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Patterson-Kelley Co., New York.
Sarco Co., New York.
Simmons Co., John, New York.
Stickle Steam Specialties Co., Indianapolis, Ind.
Trane Co., La Crosse, Wis.
Wright-Austin Co., Detroit, Mich.

Vacuum.

American Blower Co., Detroit, Mich.
Bishop & Babcock Co., Cleveland, Ohio.
Dunham Co., C. A., Chicago, Ill.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
O-E Specialty Mfg. Co., Milwaukee, Wis.
Sarco Co., New York.
Sterling Engineering Co., Milwaukee, Wis.
Stickle Steam Specialties Co., Indianapolis, Ind.
Webster & Co., Warren, Camden, N. J.
Wright-Austin Co., Detroit, Mich.

TURBINES, (Steam).

Buffalo Forge Co., Buffalo, N. Y.
Sturtevant Co., B. F., Hyde Park, Mass.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
L. J. Wing Mfg. Co., New York.

TURBO-BLOWERS.

Sturtevant Co., B. F., Hyde Park, Mass.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

UNDERGROUND PIPE CONDUITS.

American District Steam Co., No. Tonawanda, N. Y.
Hornung, P. C., Chicago, Ill.
Johns-Manville, Inc., New York.
Ric-Wil Co., Cleveland, O.
Wyckoff & Son, A., Elmira, N. Y.

VACUUM CLEANING APPARATUS.

American Radiator Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Mass.

VACUUM PRODUCERS

A. & P. Regulator Co., Park Ridge, Ill.

VALVES.

Air (Automatic.)

American Radiator Co., Chicago, Ill.
Commonwealth Brass Corporation, Detroit, Mich.
Dole Valve Co., Chicago, Ill.
Fulton Co., Knoxville, Tenn.
Haines & Co., Wm. S., Philadelphia, Pa.
Hoffman Specialty Co., New York.
Jenkins Bros., New York.
Klipfel Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
O-E Specialty Mfg. Co., Milwaukee, Wis.
Pierce, Butler & Pierce Corp., New York.
Russell & Co., W. A., New York.
Simmons Co., John, New York.

Air Relief.

American District Steam Co., No. Tonawanda, N. Y.
American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Barnes & Jones, Boston, Mass.
Crane Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Foster Engineering Co., Newark, N. J.
Fulton Co., Knoxville, Tenn.
Illinois Engineering Co Chicago, Ill.
Jenkins Bros., New York.
McAlear Mfg. Co., Chicago, Ill.
O-E Specialty Co., Milwaukee, Wis.
Powell Co., Wm., Cincinnati, O.
Russell & Co., W. A., New York.
Sterling Engineering Co., Milwaukee Wis.
Webster & Co., Warren, Camden, N. J.

Back Pressure.

Cochrane Corp., Philadelphia, Pa.
Crane Co., Chicago, Ill.
Foster Engineering Co., Newark, N. J.
Griscom-Russell Co., New York.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Kieley & Mueller, Inc., New York.
Klipfel Mfg. Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Simmons Co., John, New York.
Stickle Steam Specialties Co., Indianapolis, Ind.

Balanced.

American District Steam Co., No. Tonawanda, N. Y.
Atlas Valve Co., Newark, N. J.
Davis Regulator Co., G. M., Chicago, Ill.
Foster Engineering Co., Newark, N. J.
Klipfel Mfg. Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Stickle Steam Specialties Co., Indianapolis, Ind.

Blow-off.

Crane Co., Chicago, Ill.
Elliott Co., Jeanette, Pa.
Jenkins Bros., New York.
The Wm. Powell Co., Cincinnati, O.
Simmons Co., John, New York.

Check.

Crane Co., Chicago, Ill.
Jenkins Bros., New York.
Kennedy Valve Mfg. Co., Elmira, N. Y.
O-E Specialty Mfg. Co., Milwaukee, Wis.
Powell Co., Wm., Cincinnati, O.
Simmons Co., John, New York.

Float

American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Atlas Valve Co., Newark, N. J.
Crane Co., Chicago, Ill.
Davis Regulator Co., G. M., Chicago, Ill.
Foster Engineering Co., Newark, N. J.
Illinois Engineering Co., Chicago, Ill.
Kieley & Mueller Co., New York.
Klipfel Mfg. Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Mason Regulator Co., Boston, Mass.

Gate.

American District Steam Co., No. Tonawanda, N. Y.
Crane Co., Chicago, Ill.
Dole Valve Co., Chicago, Ill.
Jenkins Bros., New York.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Marsh Valve Co., Erie, Pa.
Powell Co., Wm., Cincinnati, O.
Simmons Co., John, New York.

Globe, Angle and Cross.

Commonwealth Brass Corp., Detroit, Mich.
Crane Co., Chicago, Ill.
Dole Valve Co., Chicago, Ill.
Jenkins Bros., New York.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Marsh Valve Co., Erie, Pa.
Pierce, Butler & Pierce Corp., New York.
Powell Co., Wm., Cincinnati, O.
Simmons Co., John, New York

Hydraulic-Operating.

Atlas Valve Co., Newark, N. J.
Crane Co., Chicago, Ill.
Klippel Mfg. Co., Chicago, Ill.

Non-Return.

American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Crane Co., Chicago, Ill.
Davis Regulator Co., G. M., Chicago, Ill.
Foster Engineering Co., Newark, N. J.
Jenkins Bros., New York.
McAlear Mfg. Co., Chicago, Ill.
Powell Co., Wm., Cincinnati, O.
Simmons Co., John, New York.

Radiator.

American Radiator Co., Chicago, Ill.
American District Steam Co., No. Tonawanda, N. Y.
Atlas Valve Co., Newark, N. J.
Barnes & Jones, Boston, Mass.
Bishop & Babcock Co., Cleveland, Ohio.
Commonwealth Brass Corporation, Detroit, Mich.
Crane Co., Chicago, Ill.
Dole Valve Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Fulton Co., Knoxville, Tenn.
Gold Car Heating & Lighting Co., Brooklyn, N. Y.
Gorton & Lidgerwood Co., New York.
Honeywell Heating Specialties Co., Wabash, Ind.
Ideal Heating Equip. Co., Cleveland, Ohio.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Kennedy Valve Mfg. Co., Elmira, N. Y.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Marsh Valve Co., Dunkirk, N. Y.
Powell Co., Wm., Cincinnati, O.
Russell & Co., W. A., New York.
Trane Co., La Crosse, Wis.
Simmons Co., John, New York.
Simplex Heating Specialty Co., Inc., Lynchburg, Pa.
Sterling Engineering Co., Milwaukee, Wis.
Webster & Co., Warren, Camden, N. J.

Reducing.

American District Steam Co., No. Tonawanda, N. Y.
Atlas Valve Co., Newark, N. J.
Davis Regulator Co., G. M., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Foster Engineering Co., Newark, N. J.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Johnson Service Co., Milwaukee, Wis.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Mason Regulator Co., Boston, Mass.
Powell Co., Wm., Cincinnati, O.
Powers Regulator Co., Chicago, Ill.
Atlas Valve Co., Newark, N. J.

Regulating.

American District Steam Co., No. Tonawanda, N. Y.
Fulton Co., Knoxville, Tenn.
Hornung, J. C., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Klipfel Mfg. Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Powell Co., Wm., Cincinnati, O.

Relief (Water)

American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Crane Co., Chicago, Ill.
Foster Engineering Co., Newark, N. J.
McAlear Mfg. Co., Chicago, Ill.
Powell Co., Wm., Cincinnati, Ohio.

Safety.

American District Steam Co., No. Tonawanda, N. Y.
American Schaeffer & Budenberg Corp., Brooklyn, N. Y.
Foster Engineering Co., Newark, N. J.
Jenkins Bros., New York.
Powell Co., Wm., Cincinnati, O.

Stop and Check.

(See Valves, Non Return.)

VENTILATING HEATERS.

Portable Unit.

American Blower Co., Detroit, Mich.
Buckeye Blower Co., Columbus, Ohio.
H. W. Nelson Co., Moline, Ill.
Nesbitt, John J., Inc., Atlantic City, N. J.
Peerless Unit Ventilating Co., New York.
Sturtevant Co., B. F., Hyde Park, Mass.

(See also Heaters, Portable Unit Air.)

VENTILATING SYSTEMS.

American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corp., Phila., Pa.
Autovent Fan & Blower Co., Chicago, Ill.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corporation, Newark, N. J.
Clarage Fan Co., Kalamazoo, Mich.
Hersh Bros. Co., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
H. W. Nelson Co., Moline, Ill.
Nesbitt, John J., Inc., Atlantic City, N. J.
New York Blower Co., Chicago, Ill.
Peerless Unit Ventilating Co., New York.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Mass.
L. J. Wing Mfg. Co., New York.

VENTILATORS.

Allen Air-Turbine Ventilator Co., Detroit, Mich.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, N. Y.
Ilg Electric Ventilating Co., Chicago, Ill.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Mass.
L. J. Wing Mfg. Co., New York.

Mushroom.

Hersh Brothers Co., Allentown, Pa.
Knowles Mushroom Ventilator Co., New York.
Lyon Products Co., Chicago, Ill.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Mass.

WEATHER STRIPS.

Metal.

Athey Company, Chicago, Ill.
Higgin Manufacturing Co., Newport, Ky.
Monarch Metal Products Co., St. Louis, Mo.

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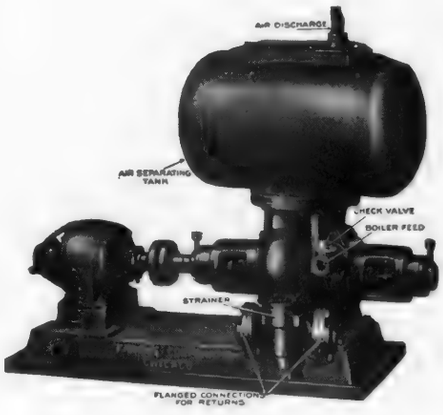
STEAM SEPARATORS EXHAUST HEADS
OIL SEPARATORS BOILER ALARM WATER COLUMNS
STRAINERS
WRIGHT
AUSTIN
WRIGHT-AUSTIN CO.
DETROIT, MICHIGAN

SKIDMORE HYDRO TURBINE VACUUM AND BOILER FEED PUMP



SET THEM AS THEY COME CONNECT RETURNS, WIRE MOTOR AND RUN

Operates on a different principle.

Simple, Efficient and Sure.

Manufactured of highest grade material along lines of best engineering practice.

All parts are accurately machined.

The base, casing, bearing brackets and tank are fine-grained cast iron.

The shaft is Tobin Bronze carried on heavy ball bearings

The air rotor and centrifugal pump are bronze castings.

The Skidmore occupies half the floor space required for other makes of pumps.

A self-contained unit requiring no piping.

Engineers requiring the best and wanting a pump, the high efficiency of which remains constant, should specify the Skidmore.

Bulletin No. 2 will be sent on request.

Built in five sizes for 10 and 20 lbs. pressure to handle 8000, 16000, 26000, 40000, and 65000 sq. ft. of radiation, for c ntinuous service or with automatic control.

SKIDMORE CORPORATION

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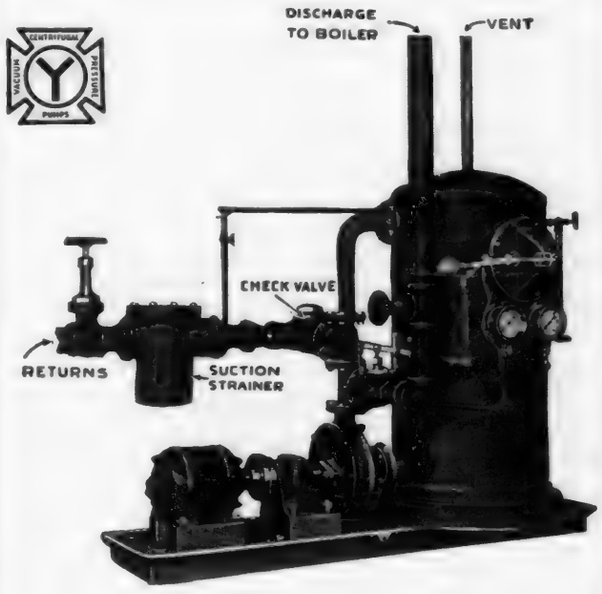
1535 Dayton St. CHICAGO, U. S. A.



Simplicity is its big advantage

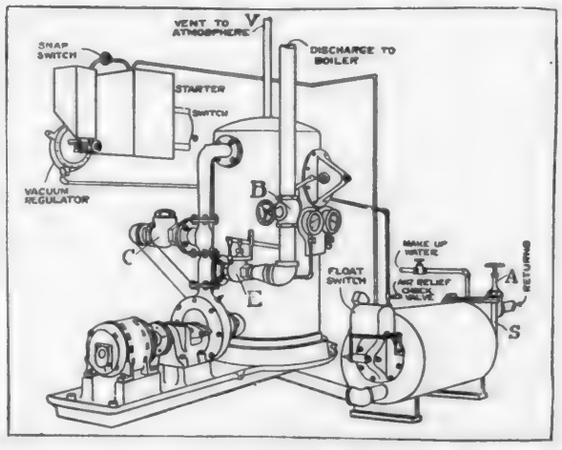
THE simplicity of the Young Centrifugal Vacuum and Boiler Feed Pump is clearly shown in the illustration above. The line drawing reproduced below also reveals the simplicity of the Pump when equipped with automatic vacuum control and with float controlled accumulator tank. This latter installation is particularly desirable where there is blast or other radiation at a low level that should be kept free from condensation.

There is no question of the superiority of Young Pumps for vacuum and low pressure boiler feed work. The fact that these pumps are the acme of simplicity enables an ordinary fireman to take care of their operation with ease.

YOUNG PUMP COMPANY

230 East Ohio Street, Chicago

Factory: Michigan City, Indiana



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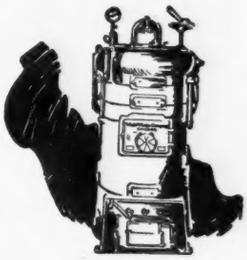

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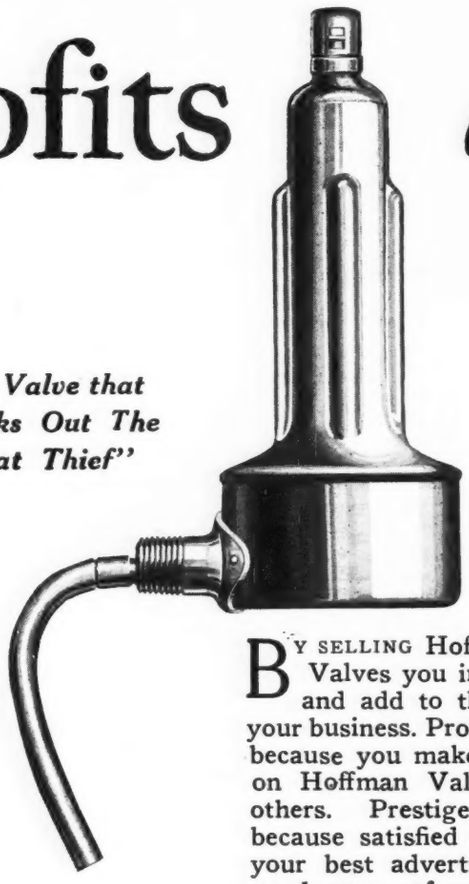

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